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TEXAS ENGINEERING EXPERIMENT STATION
The Texas A&M University System
COLLEGE STATION, TEXAS 77843

SPACE SHUTTLE ICE SUPPRESSION SYSTEM VALIDATION
TEES-TR-4587-82-01
VOLUME III

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Prepared by
Texas Engineering Experiment Station
Texas A&M University
College Station, Texas 77843

PRESSURE DATA

NOMINAL CONFIGURATION

GROUP I

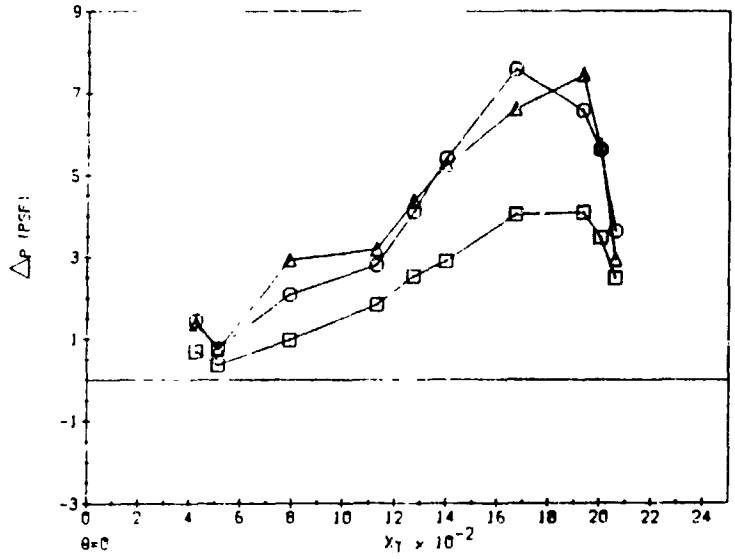
INFLUENCE OF NOZZLE SIZE, NO WIND

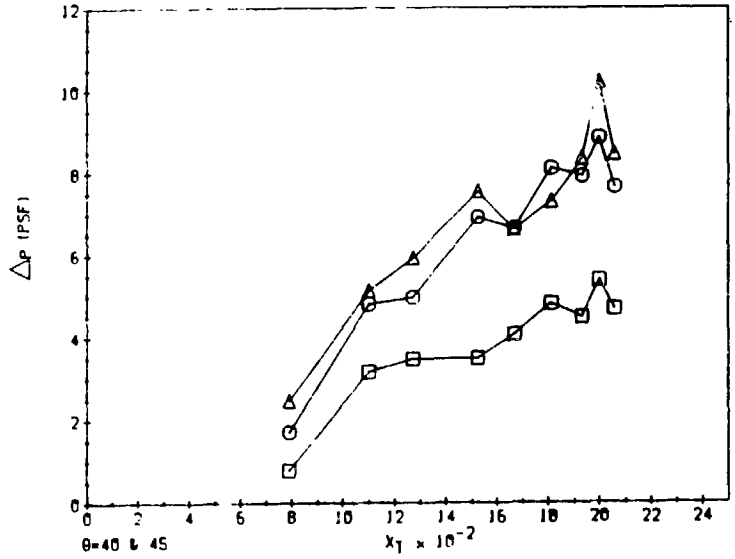
RUNS 11, 12.1 and 13

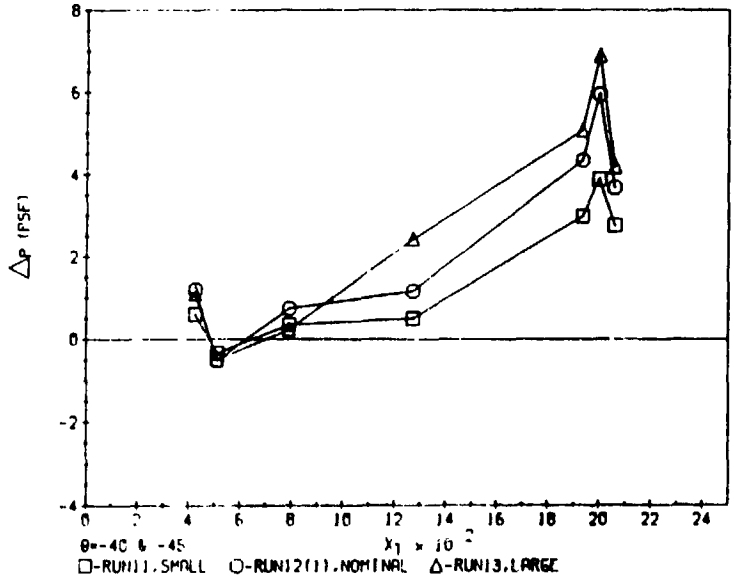
P = 32 psia

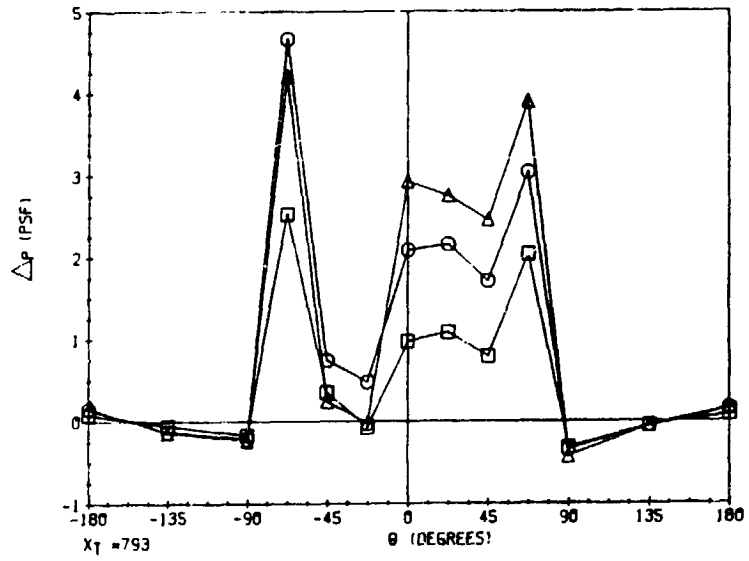
V = 0 KNOTS

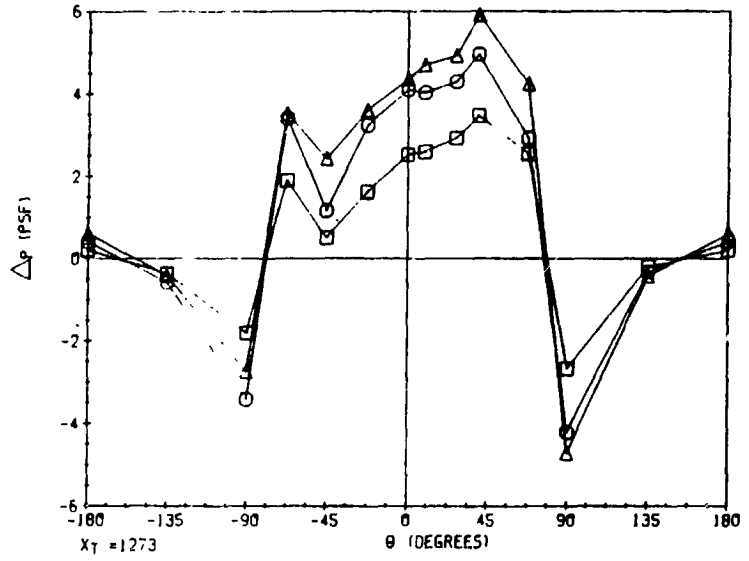
ϕ = 0°

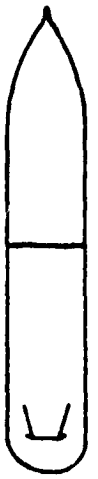


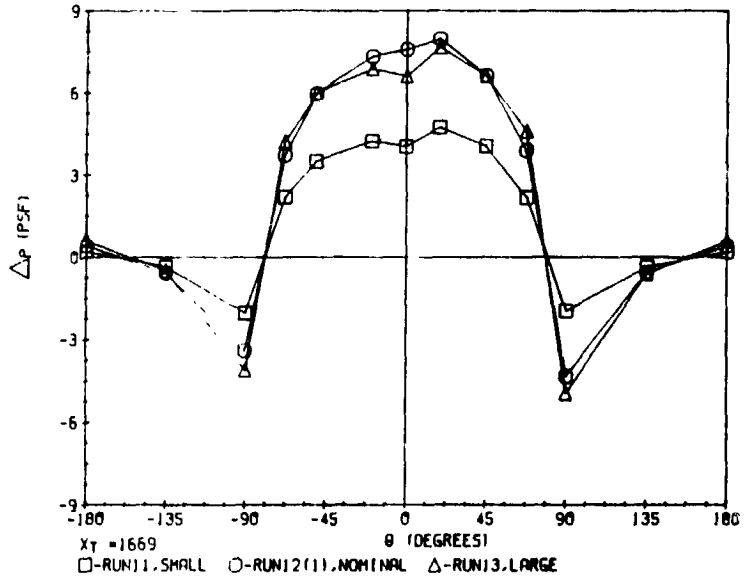


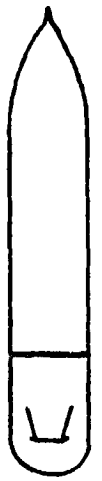


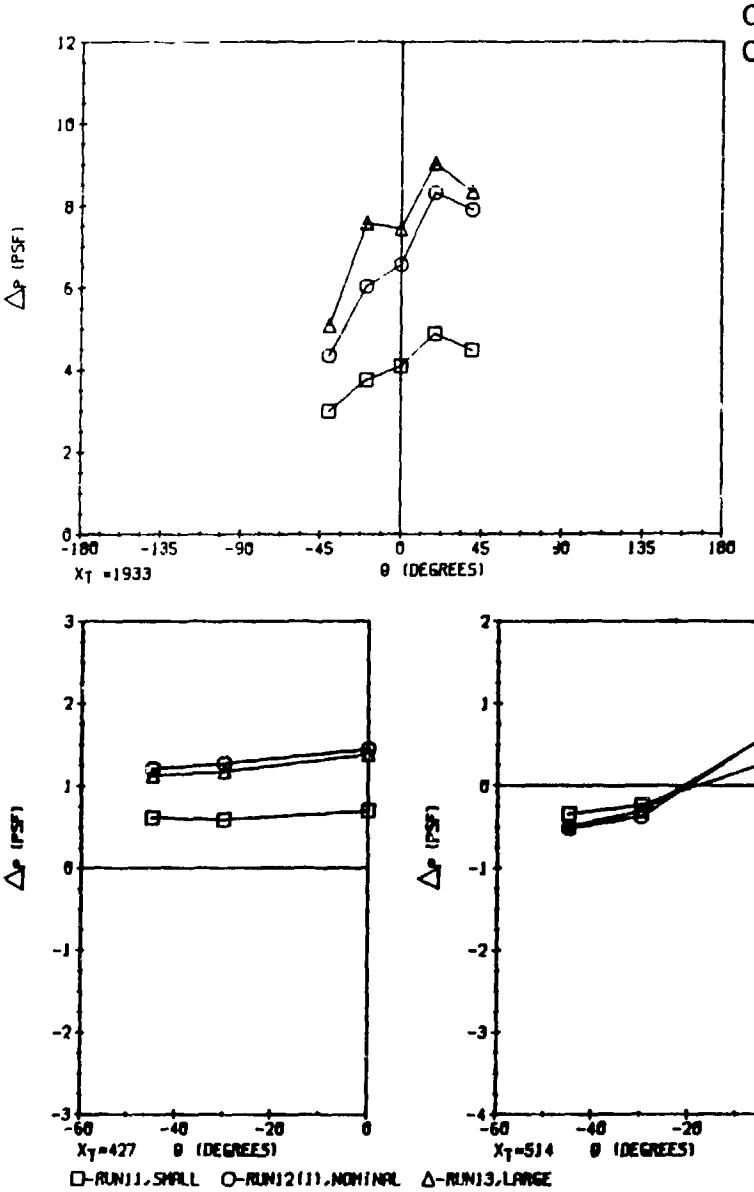












NOMINAL CONFIGURATION

GROUP II

INFLUENCE OF NOZZLE SIZE ON WIND PENETRATION

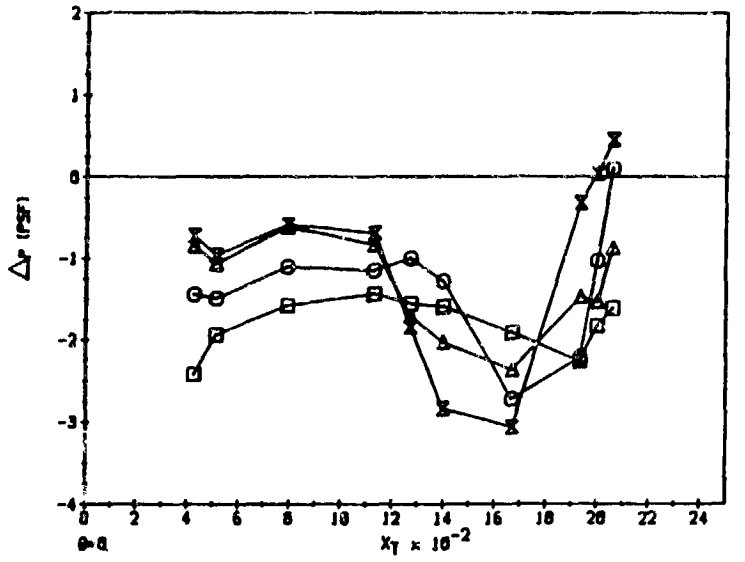
RUNS 7, 9.1, 5 and 8

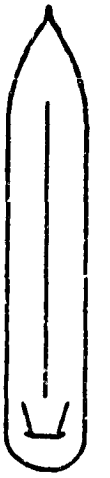
P = 32 psia

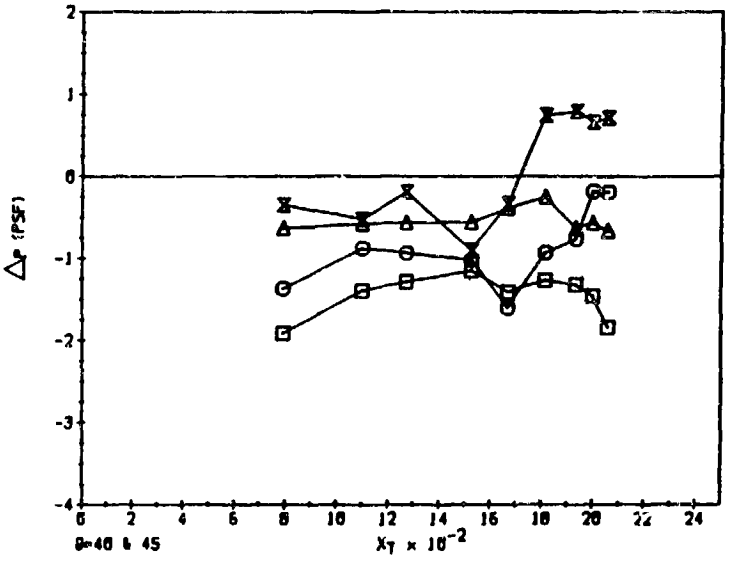
V = 20 KNOTS

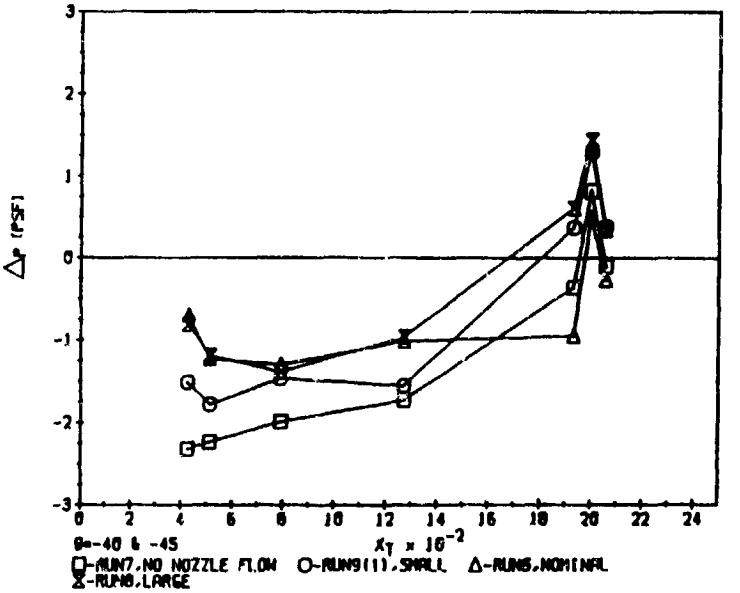
β = 338°

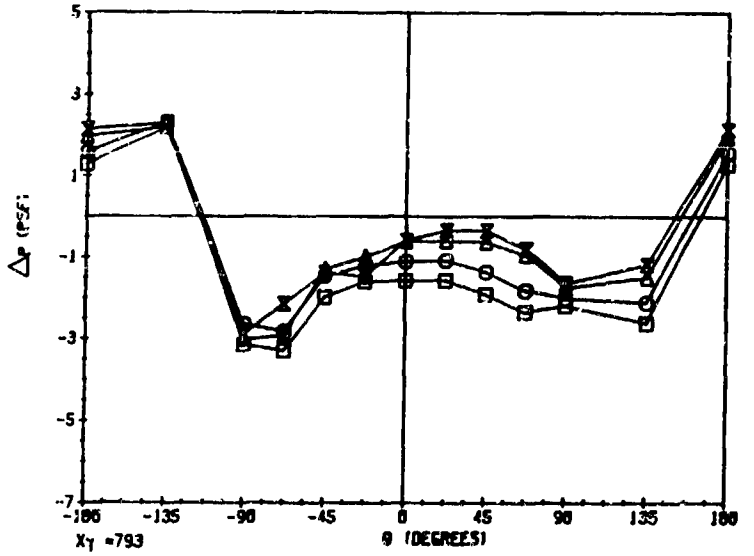
ϕ = -30°

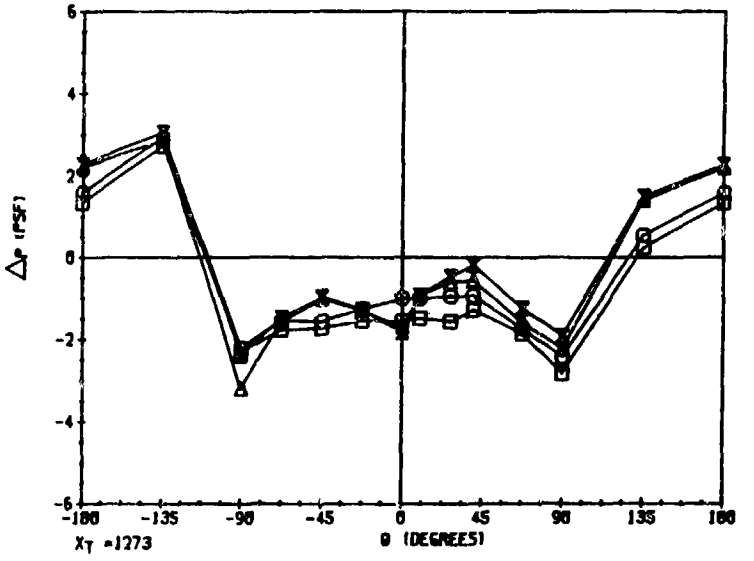


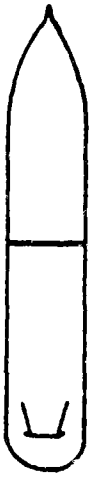


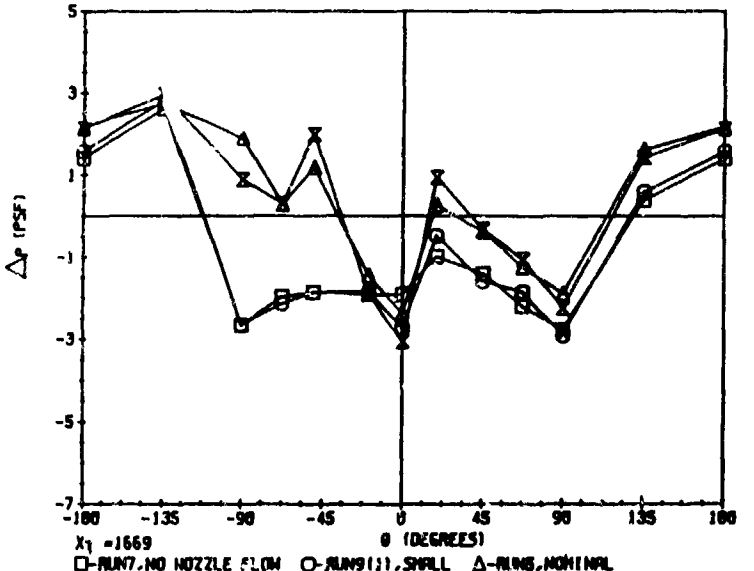


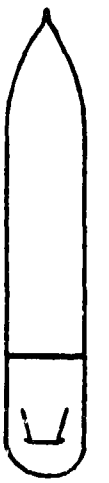


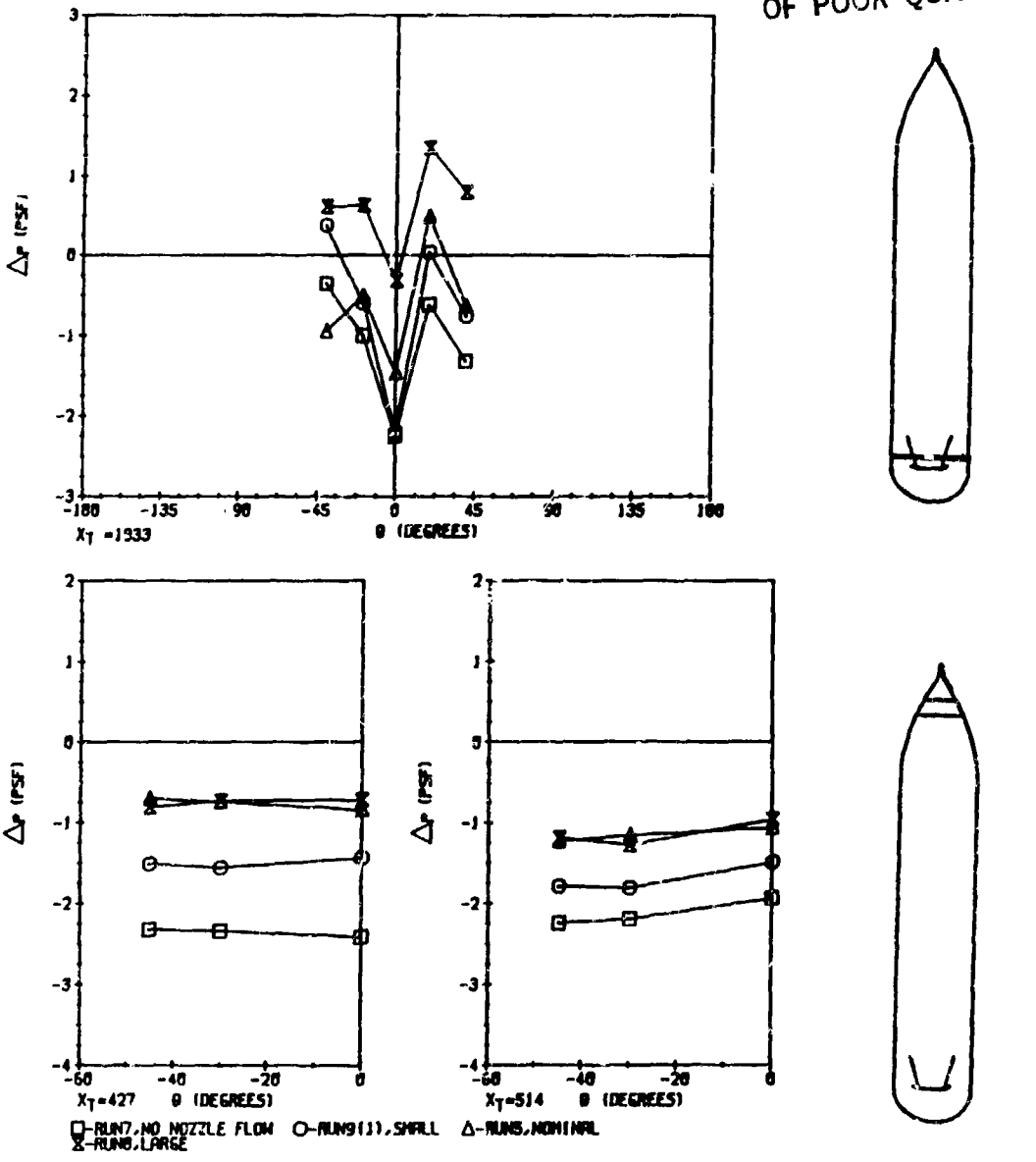












NOMINAL CONFIGURATION

GROUP III

INFLUENCE OF NOZZLE PRESSURE ON WIND PENETRATION

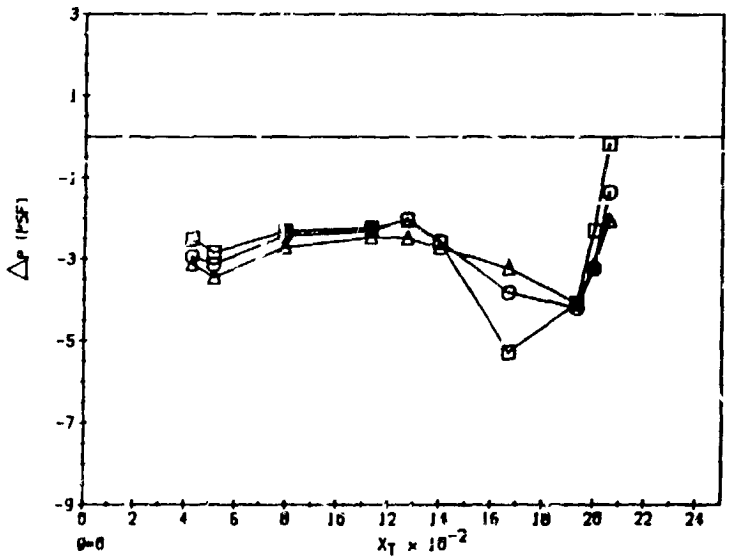
RUNS 6.1, 6.2 and 6.3

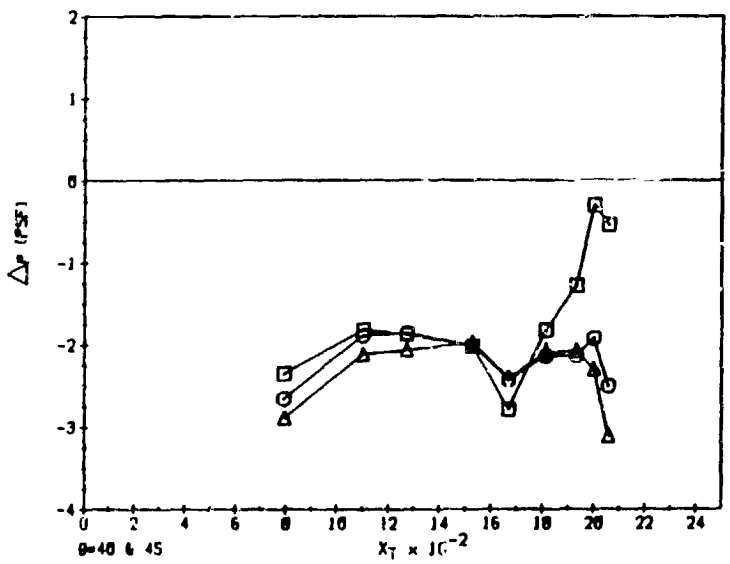
V = 30 KNOTS

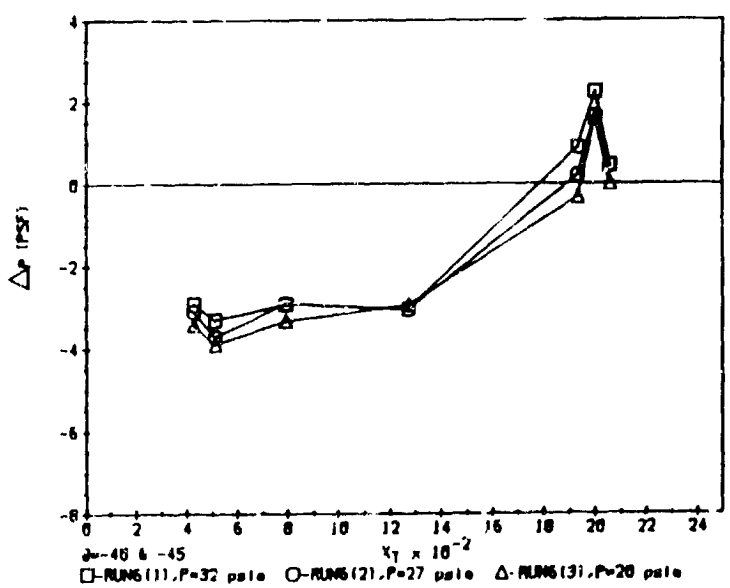
β = 338°

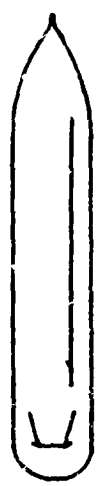
ϕ = 0°

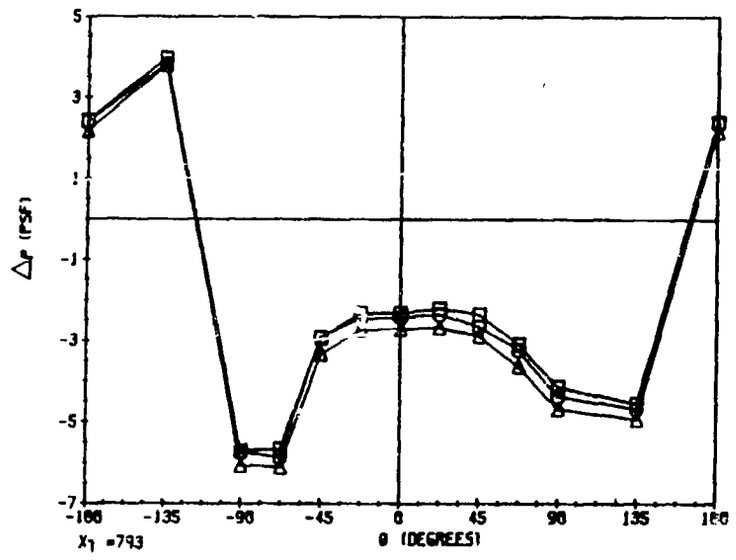
Nominal Nozzles

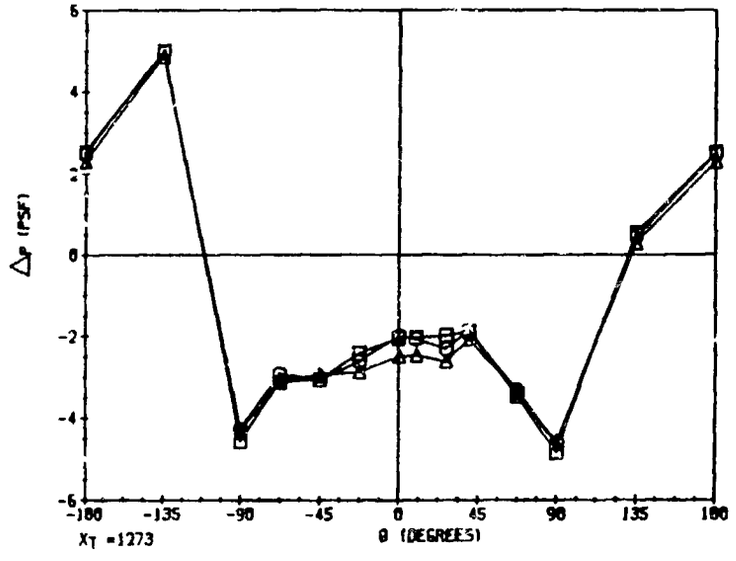


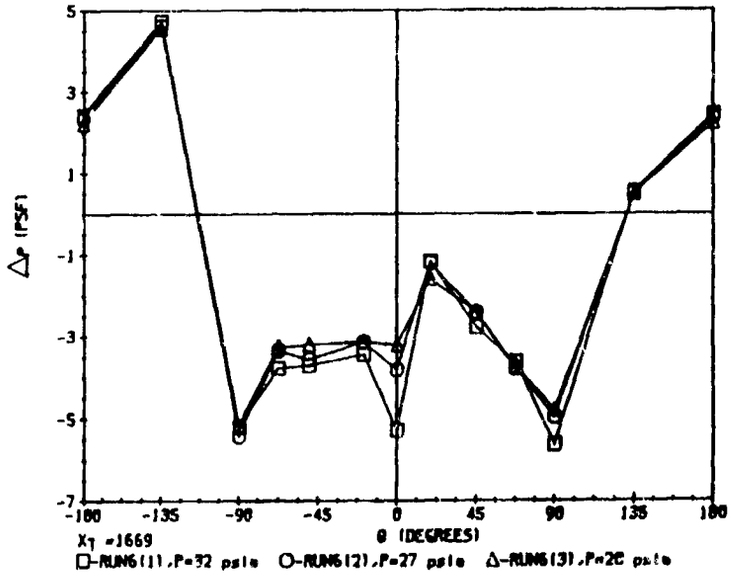


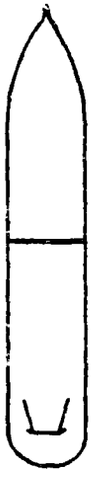


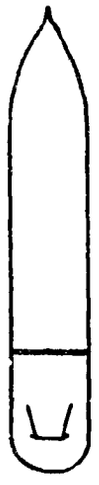


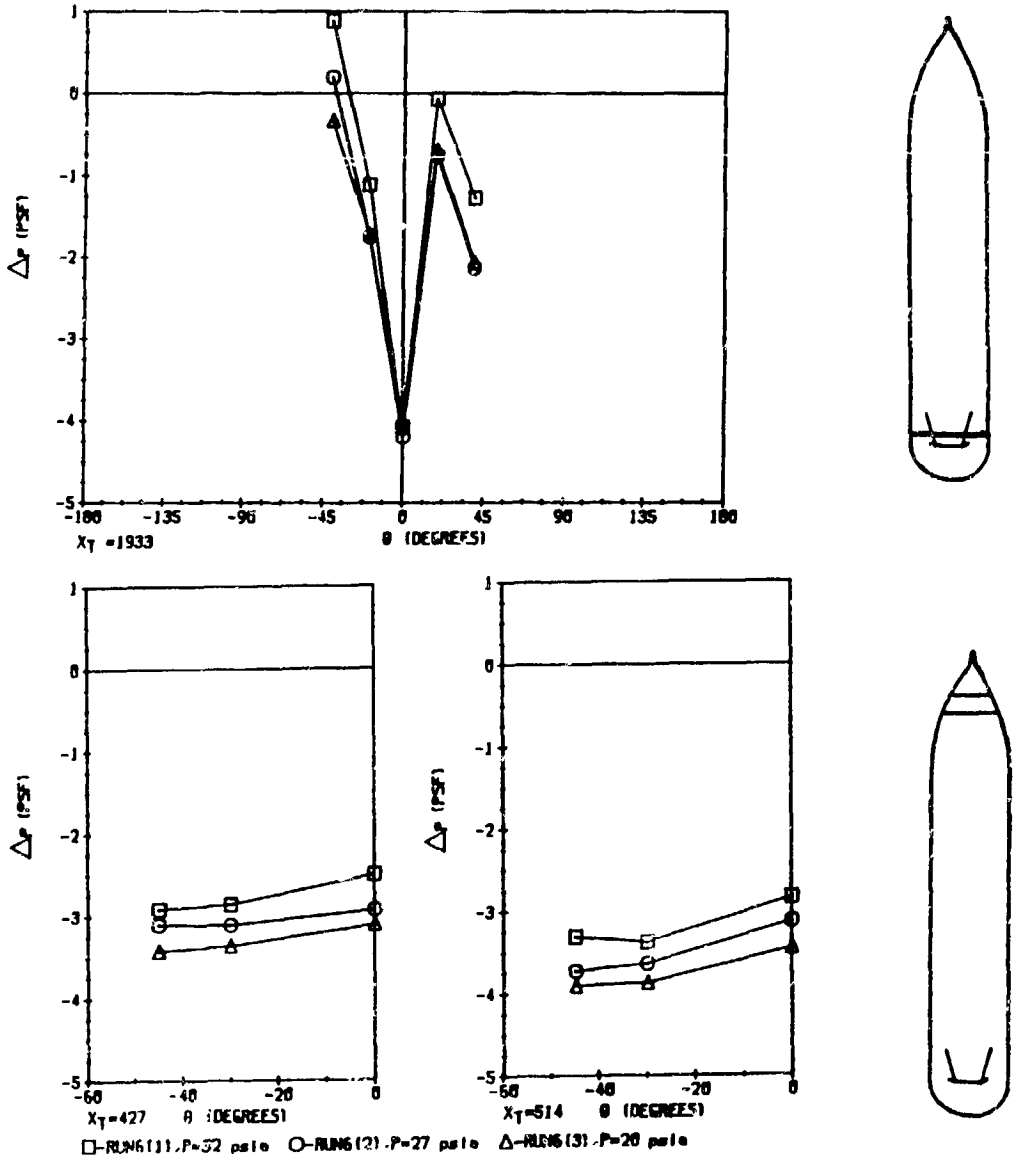












NOMINAL CONFIGURATION

GROUP IV

WIND VELOCITY EFFECTS AT 338°

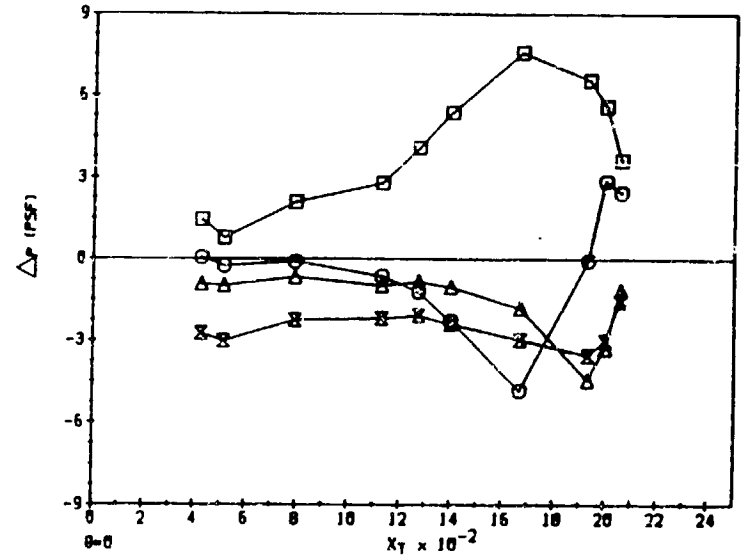
RUNS 12.1, 3, 1 and 2

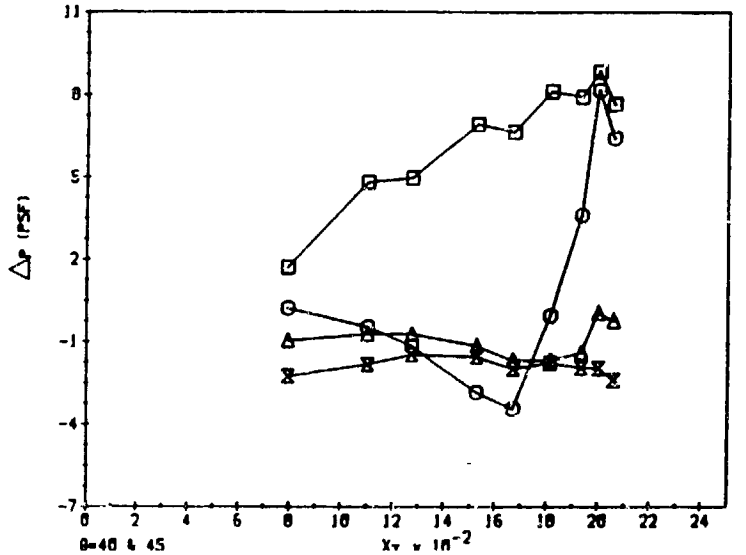
P = 32 psia

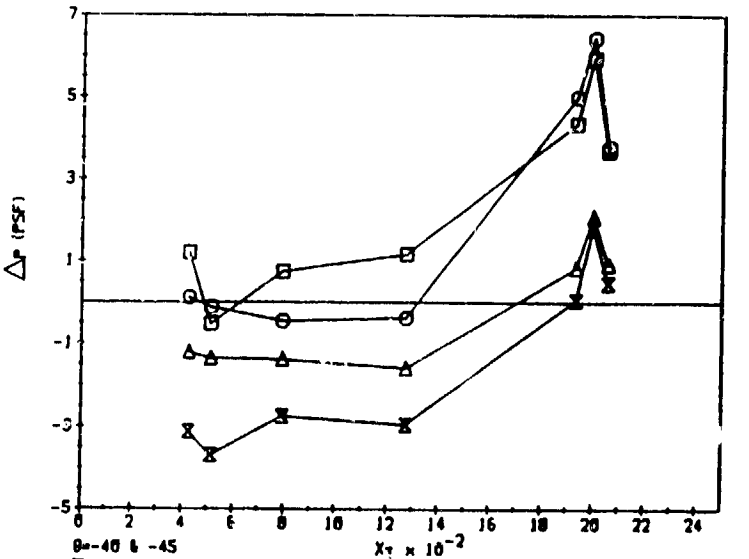
β = 338°

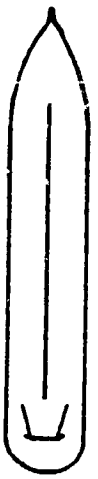
ϕ = 0°

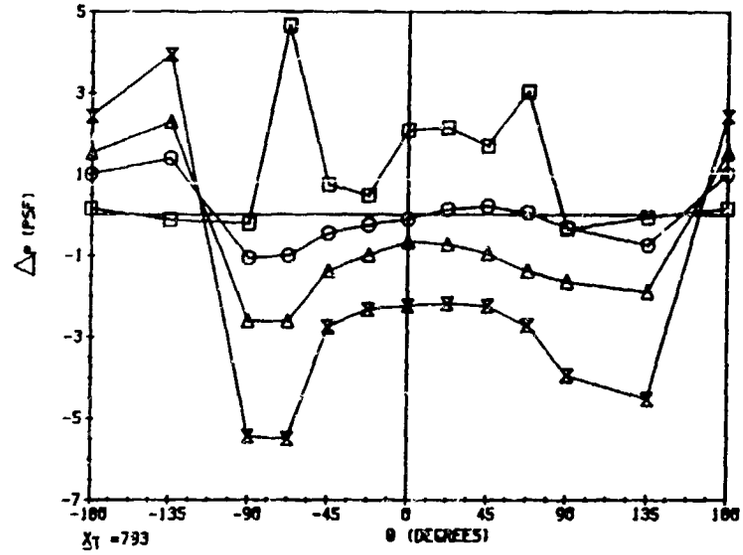
Nominal Nozzles

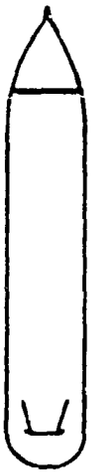


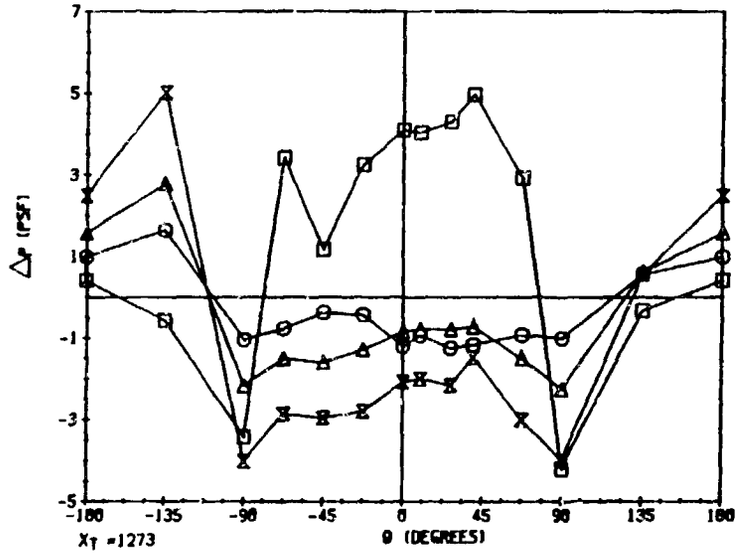


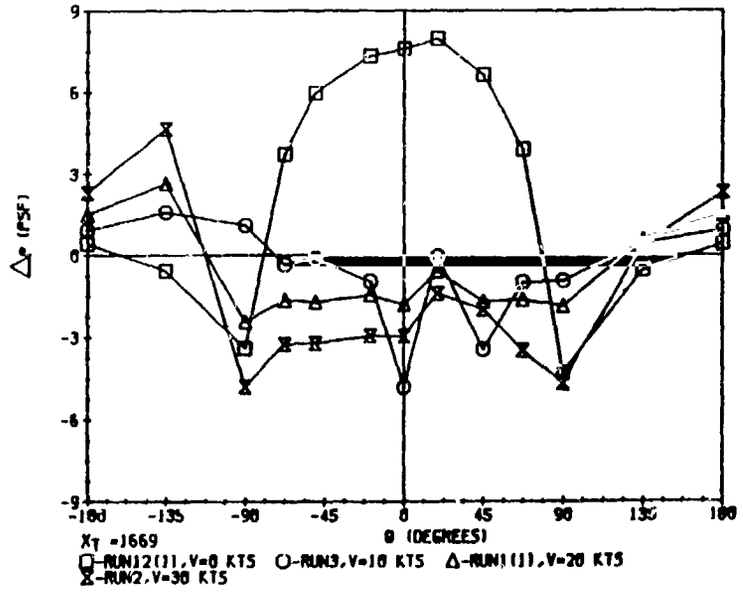


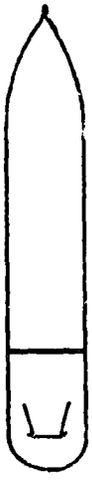


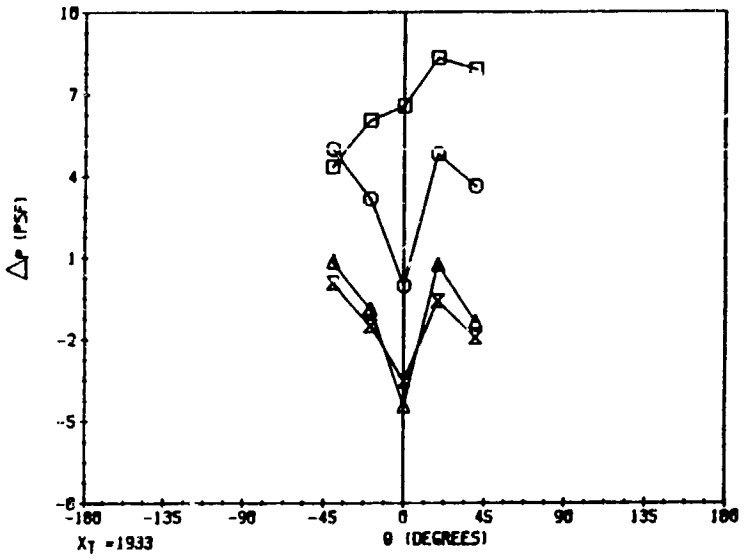


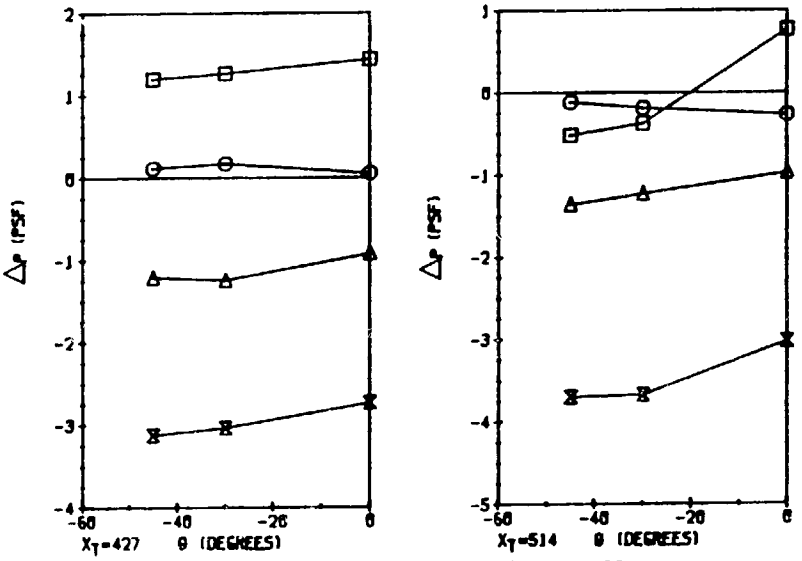


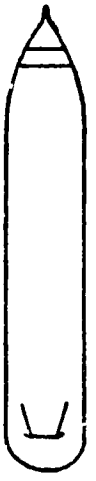












NOMINAL CONFIGURATION

GROUP V

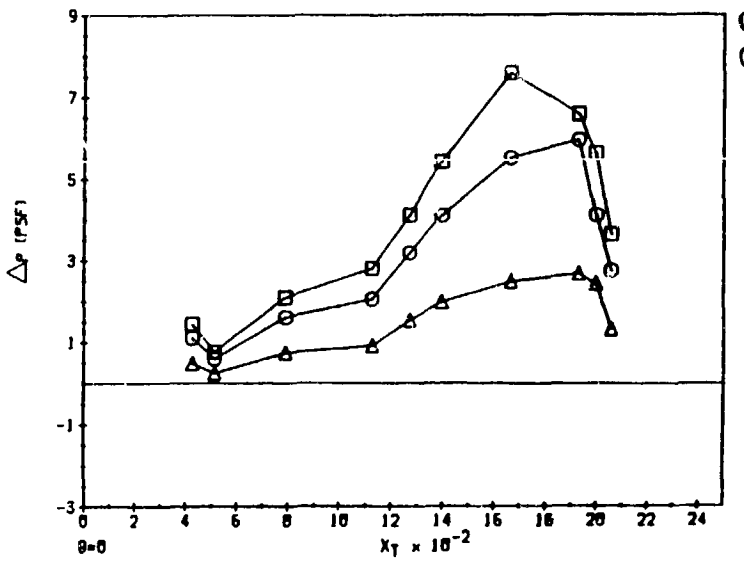
NOZZLE PRESSURE EFFECTS, NO WIND

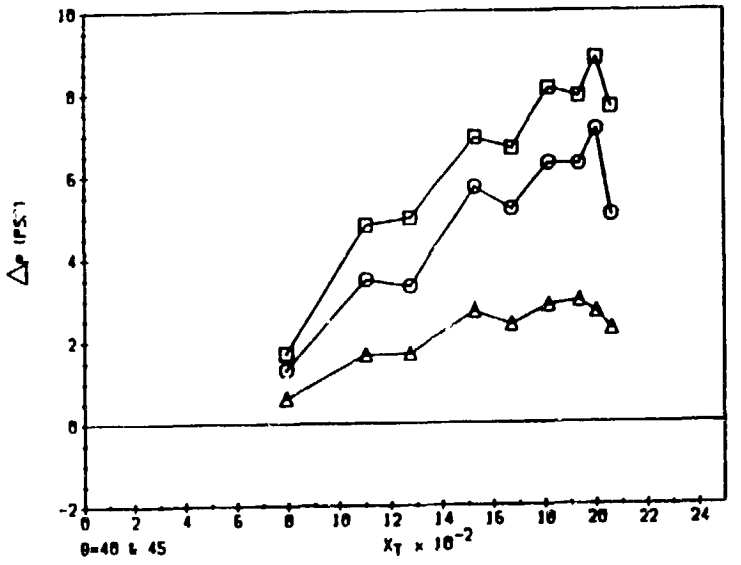
RUNS 12.1, 12.2 and 12.3

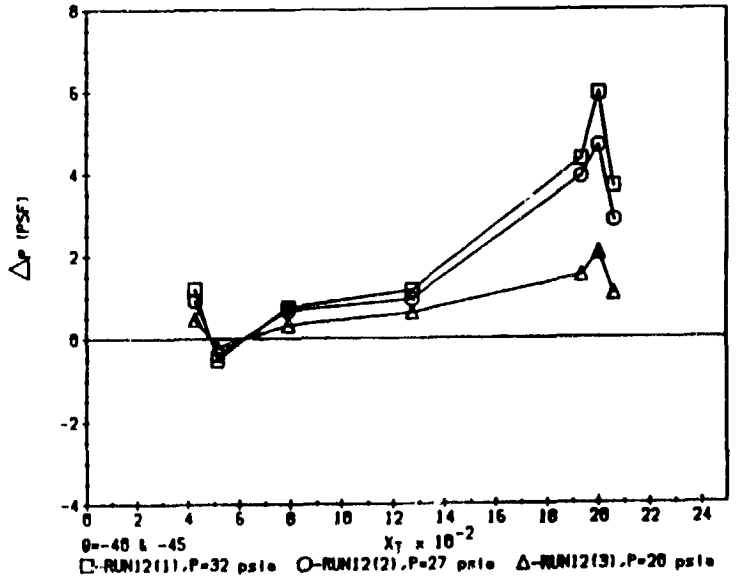
V = 0 KNOTS

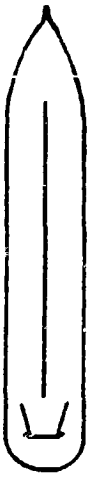
ϕ = 0°

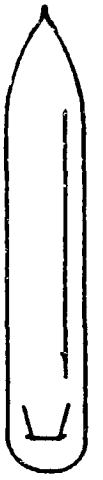
Nominal Nozzles

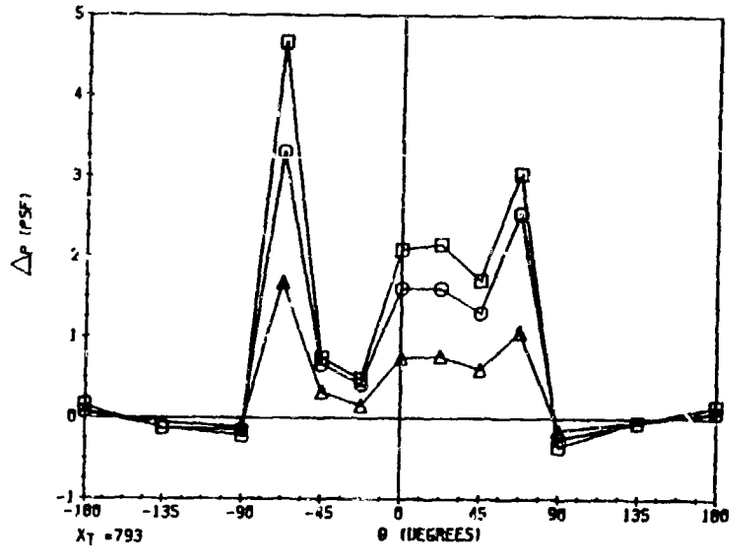


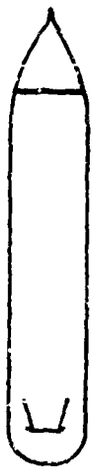


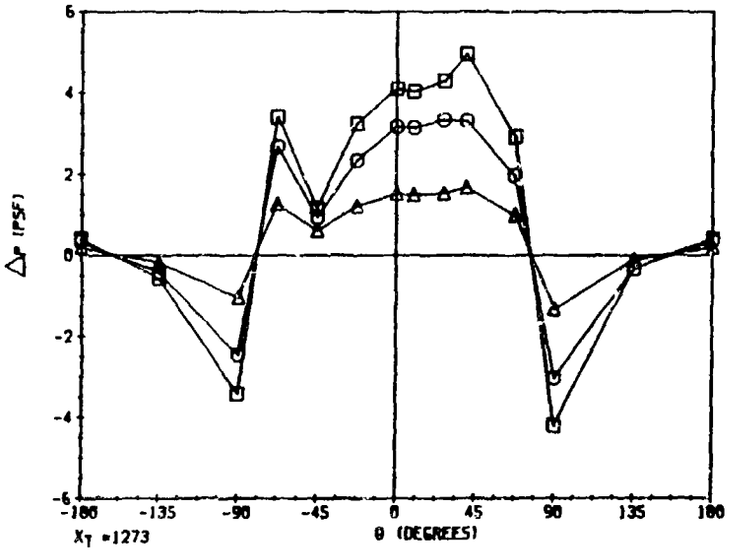


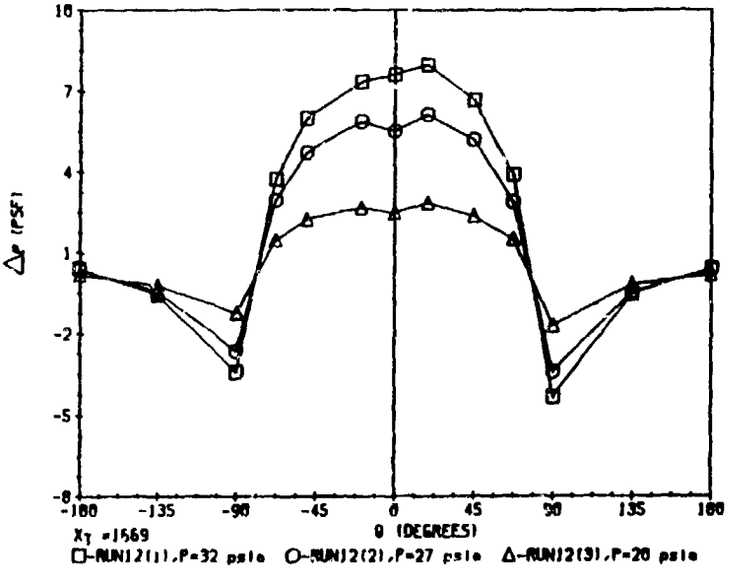


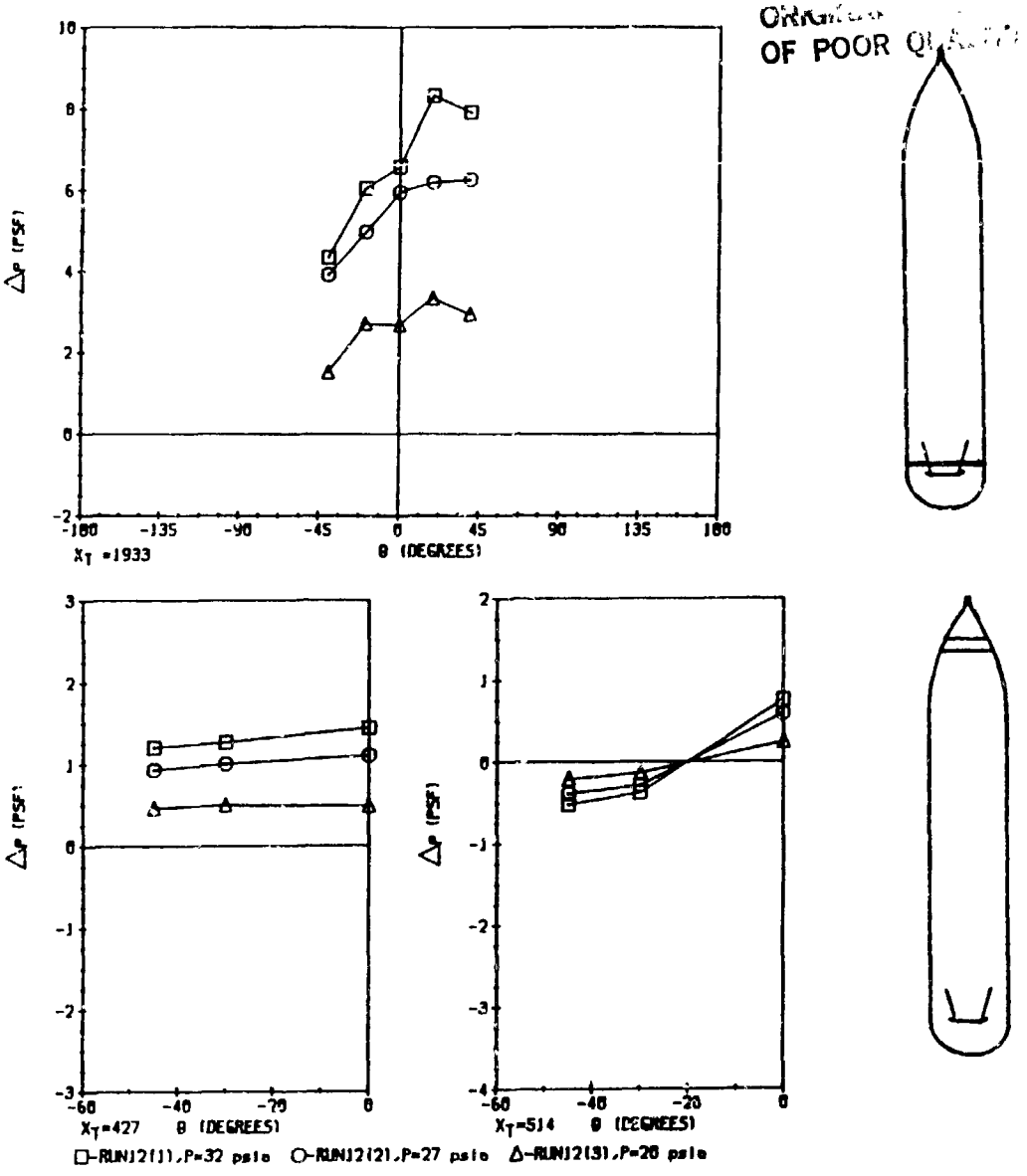












NOMINAL CONFIGURATION

GROUP VI

WIND VELOCITY EFFECTS AT 112°

RUNS 12.1, 17.1, 17.2, 17.3 and 17.4

P = 32 psia

β = 112°

ϕ = 0°

Nominal Nozzles

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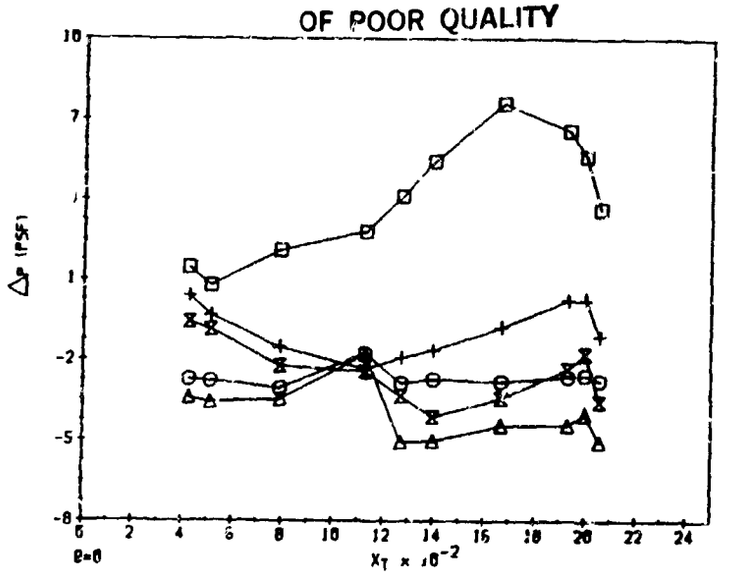
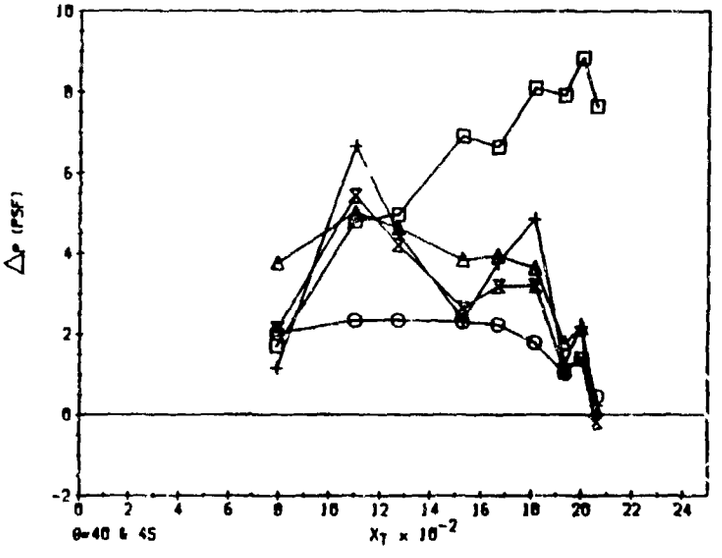
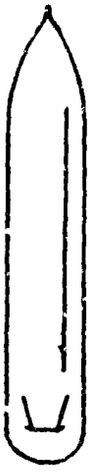
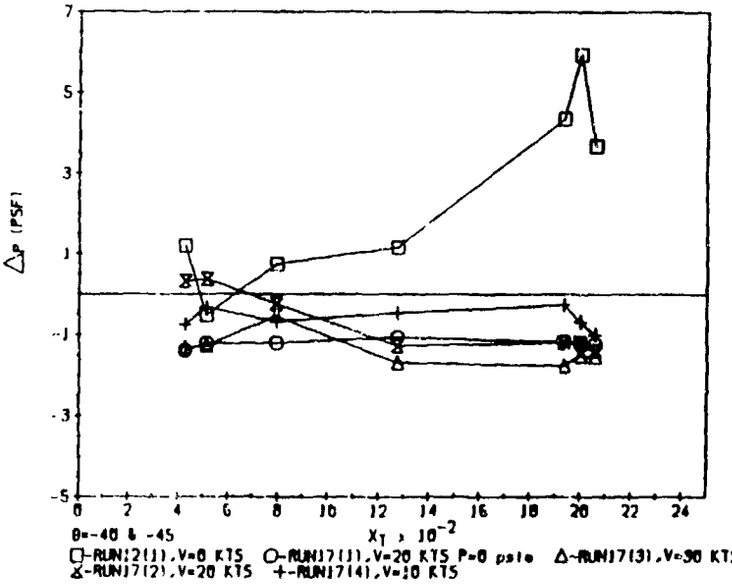
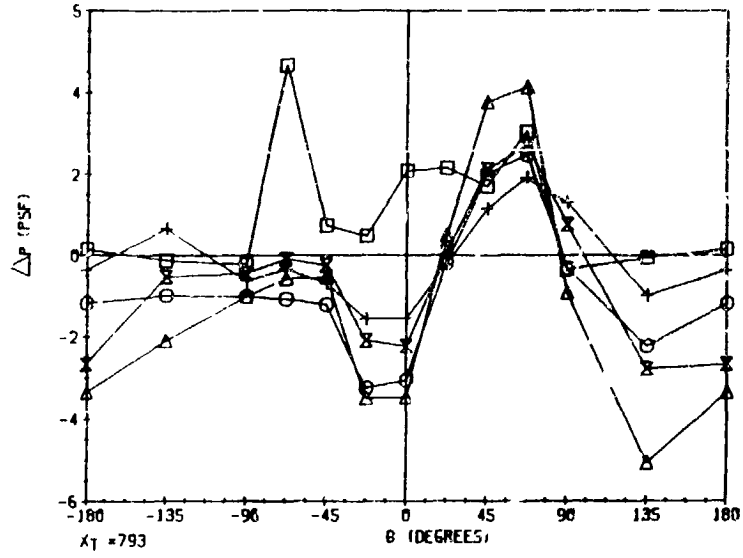
OF POOR QUALITY

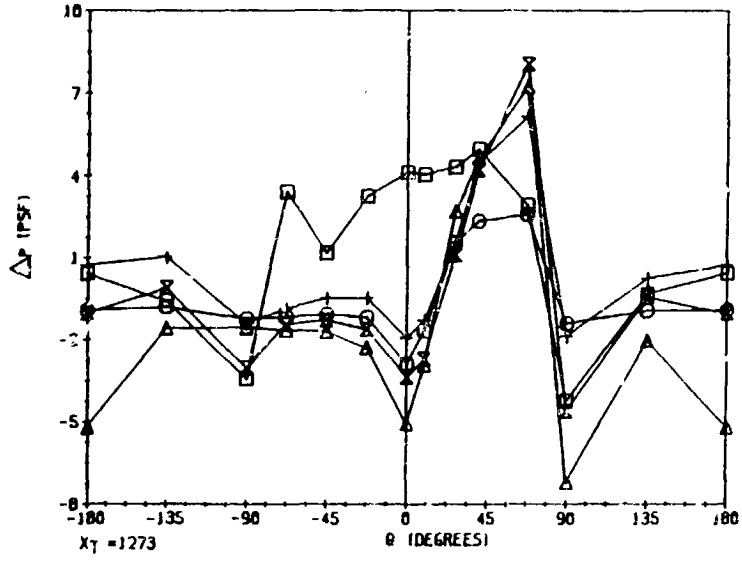


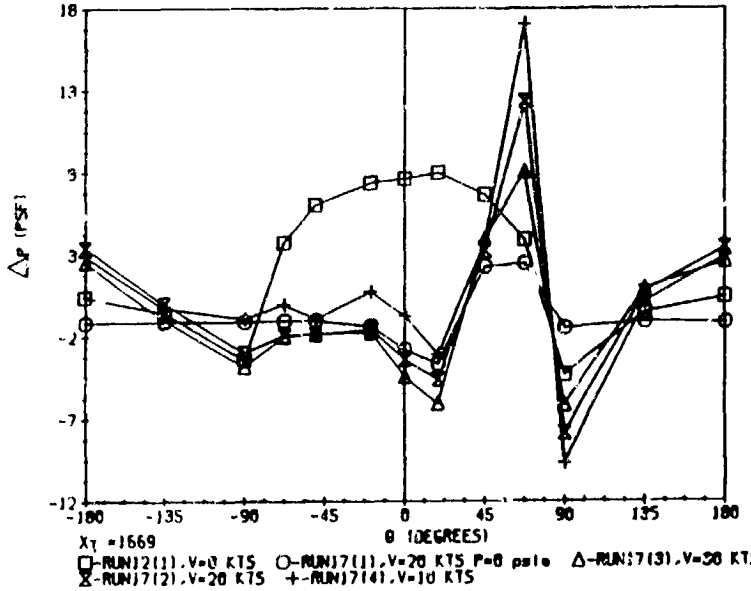


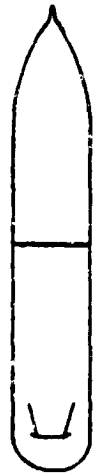


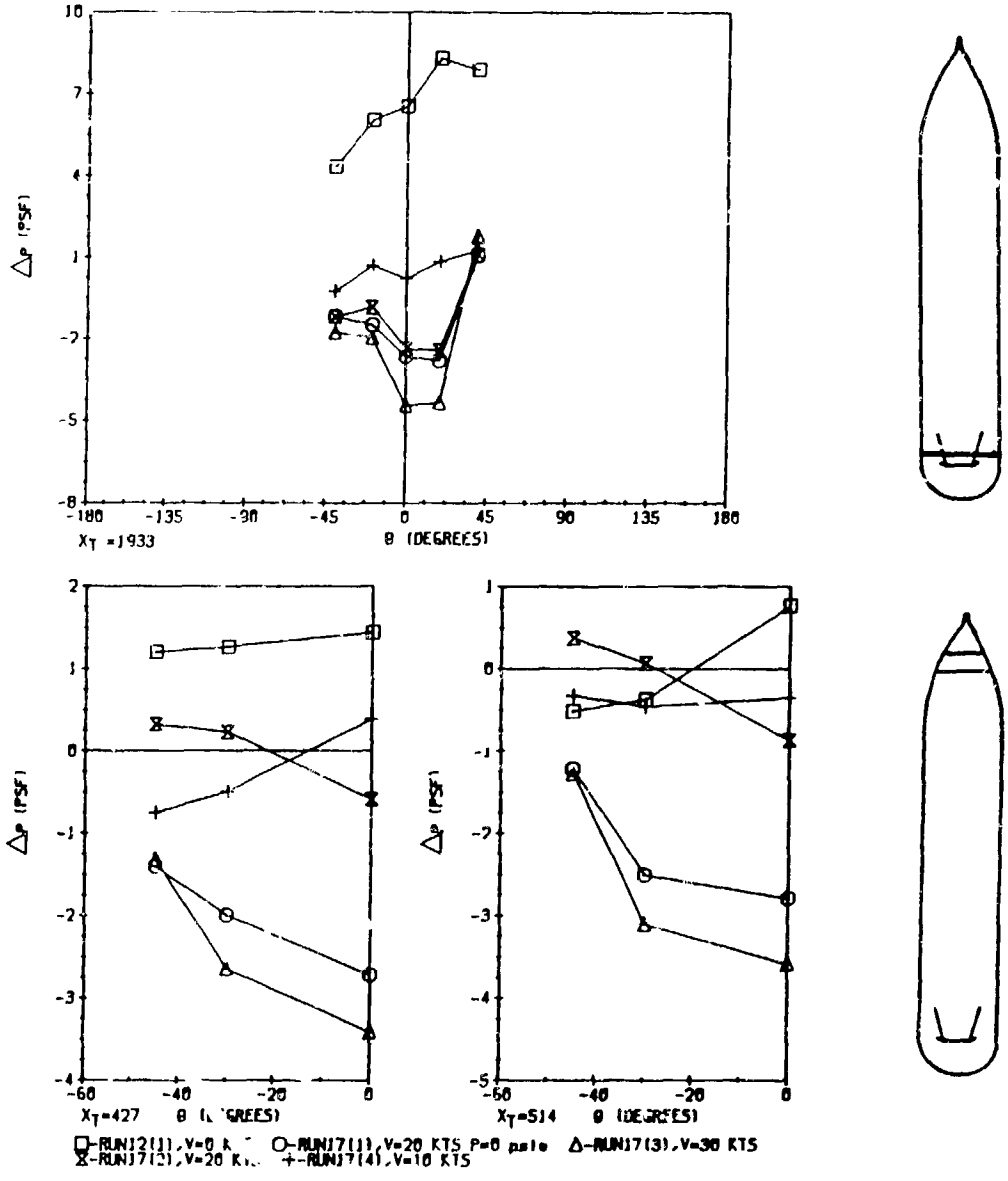












NOMINAL CONFIGURATION

GROUP VII

NOMINAL VELOCITY EFFECTS AT 202°

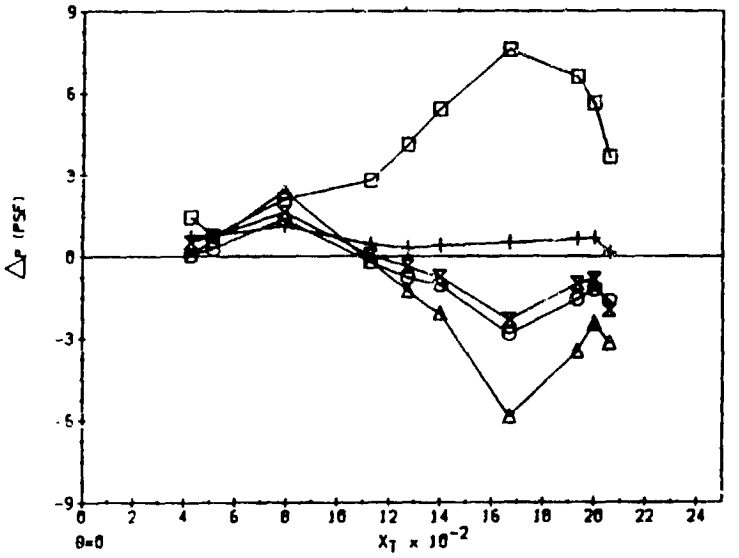
RUNS 12.1, 14, 16.1, 15 and 16.2

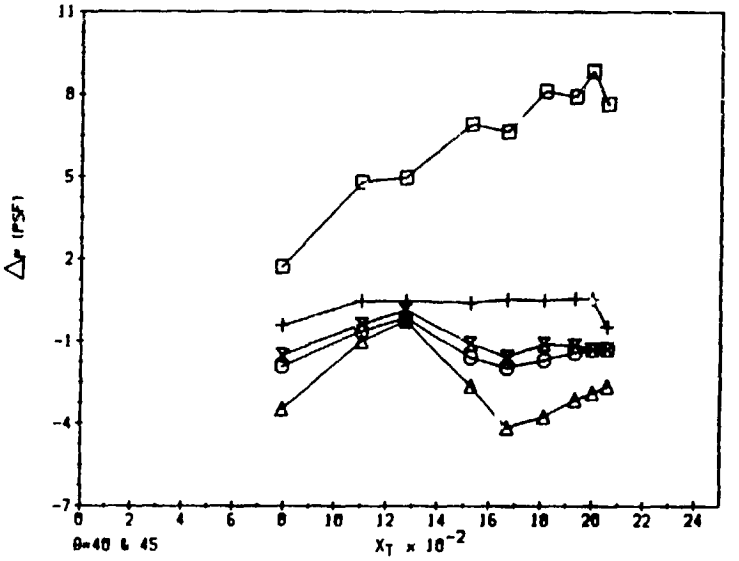
P = 32 psia

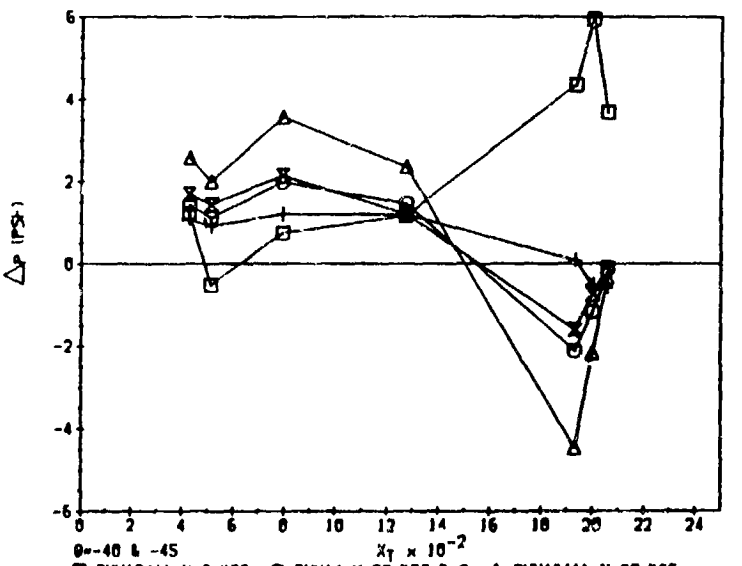
β = 202°

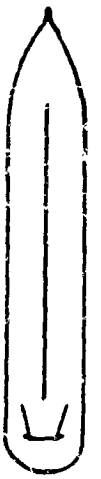
ϕ = 0°

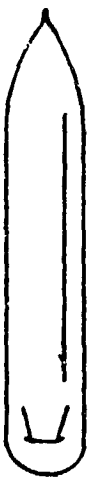
Nominal Nozzles

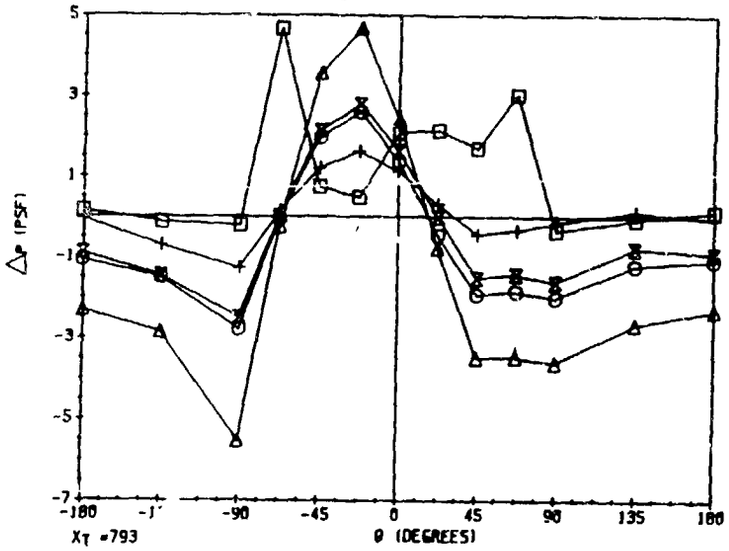


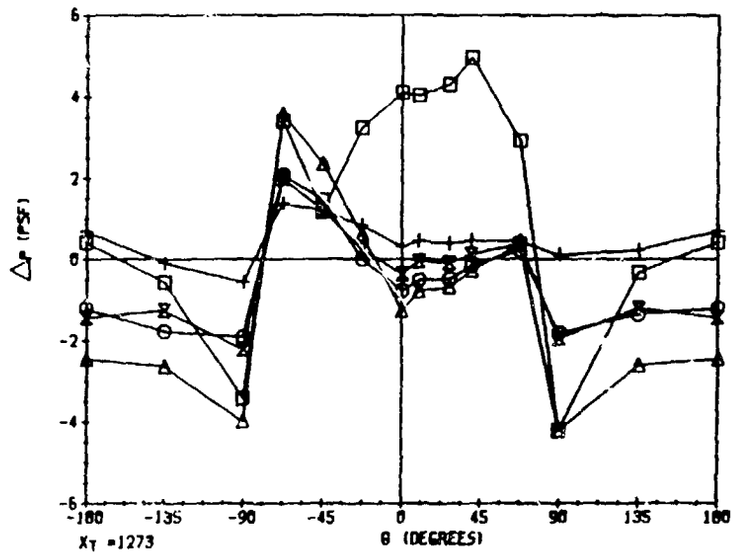


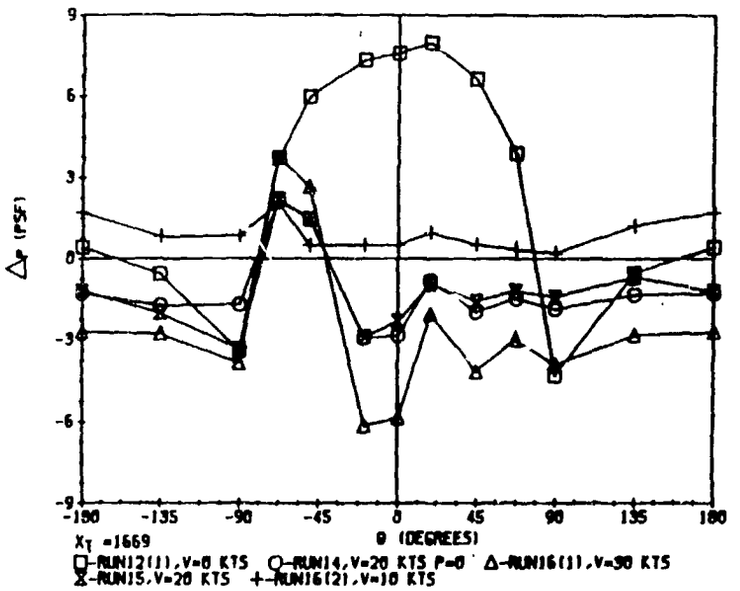


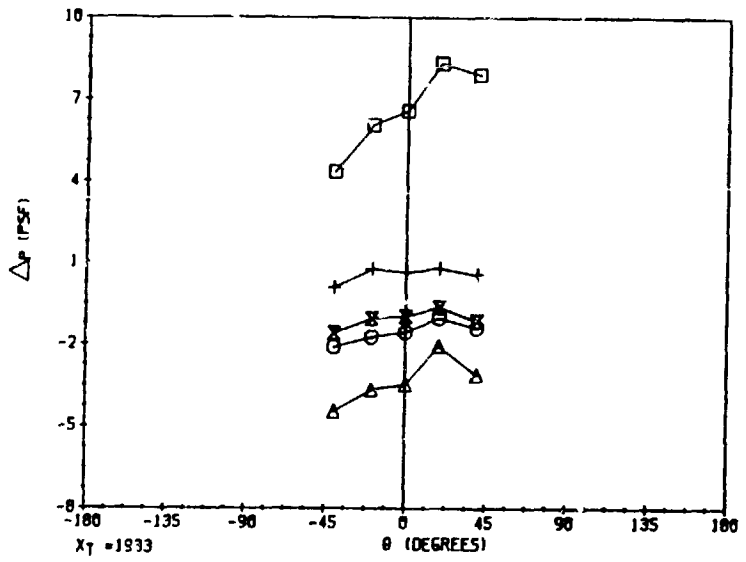


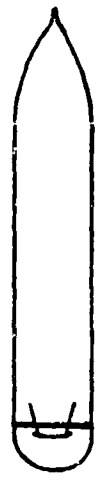


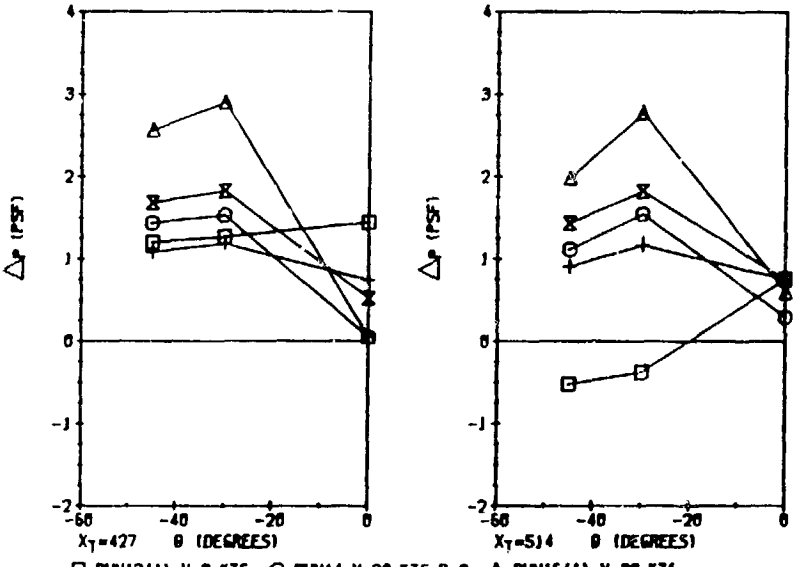












□-RUN12(1),V=0 KTS ○-RUN14,V=20 KTS P=0 Δ-RUN16(1),V=30 KTS
⧖-RUN15,V=20 KTS +-RUN16(2),V=30 KTS

NOMINAL CONFIGURATION

GROUP VIII

WIND VELOCITY EFFECTS ON WIND PENETRATION

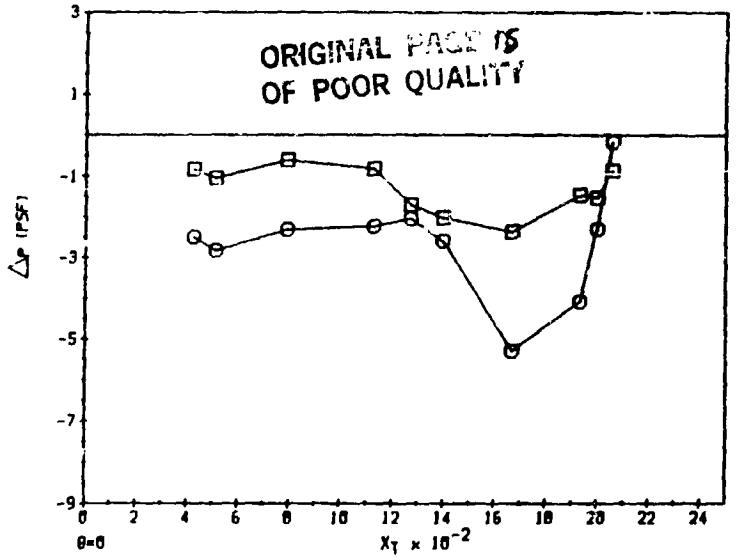
RUNS 5 and 6.1

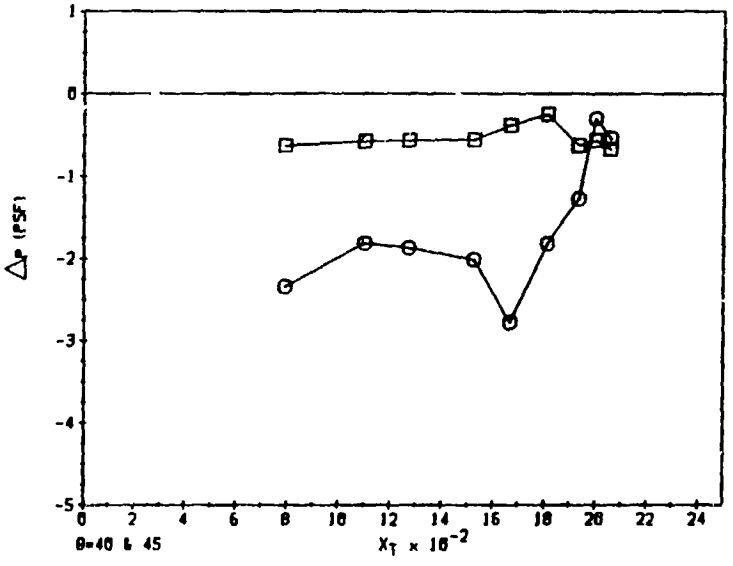
P = 32 psia

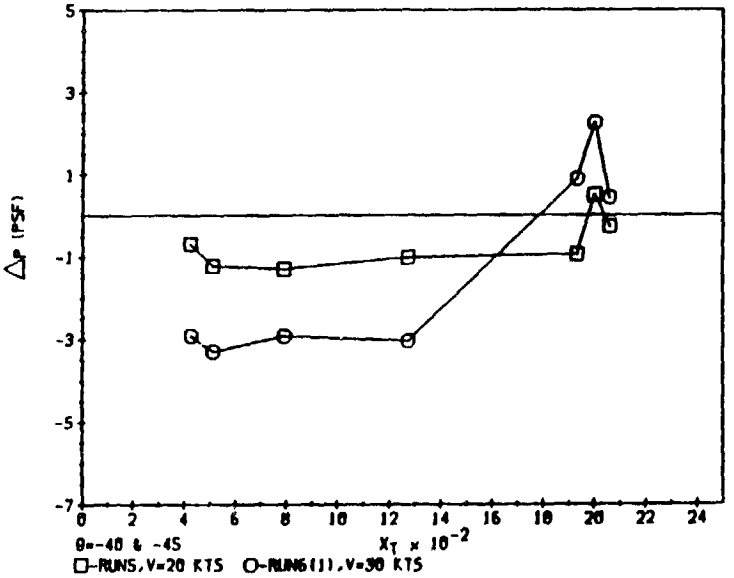
β = 338°

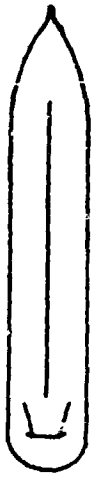
ϕ = -30°

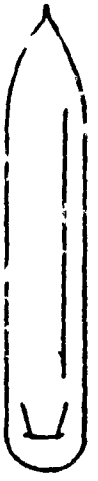
Nominal Nozzles

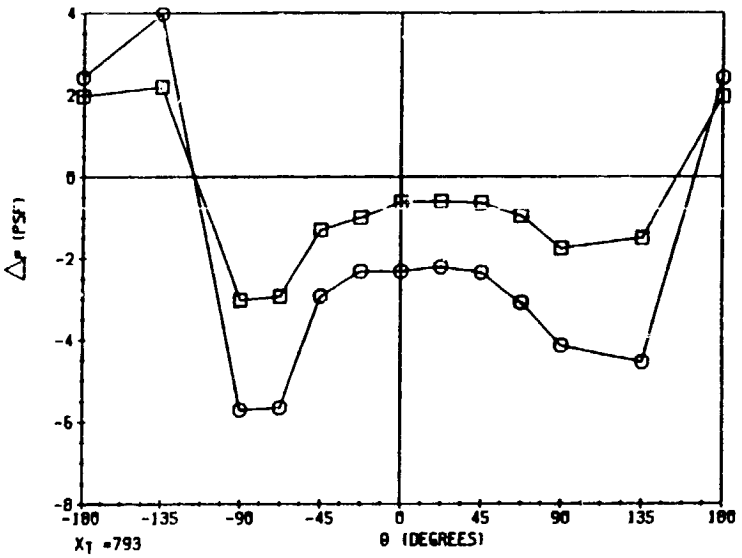


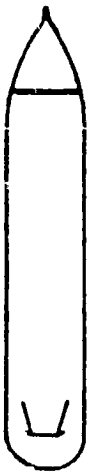


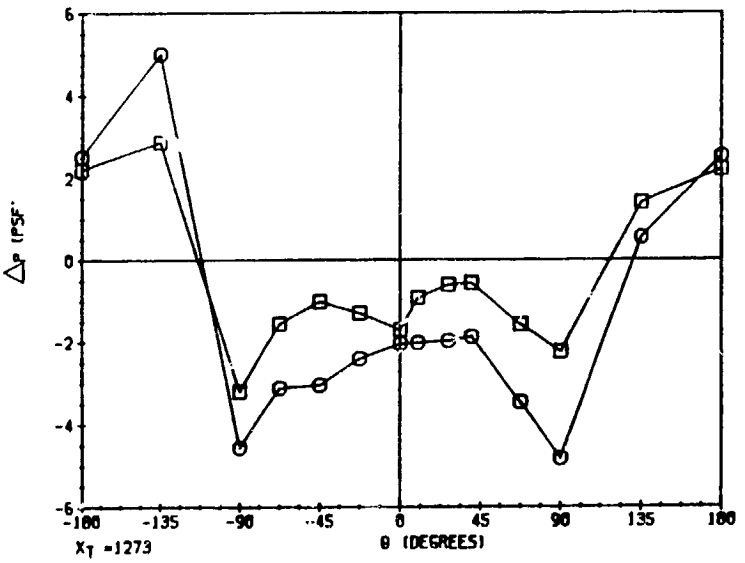


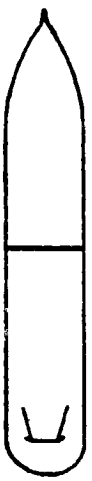


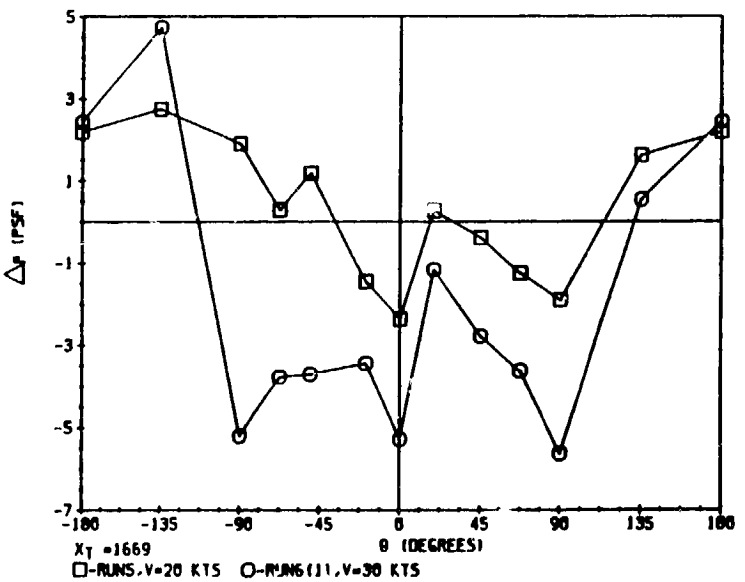


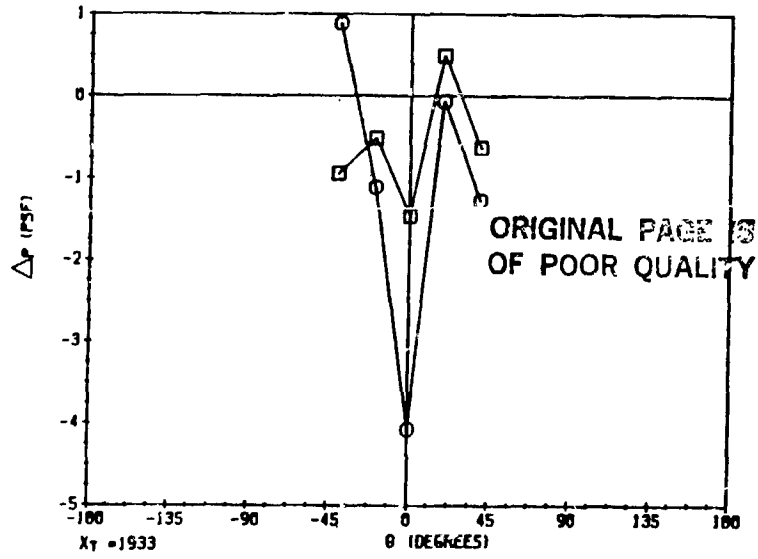


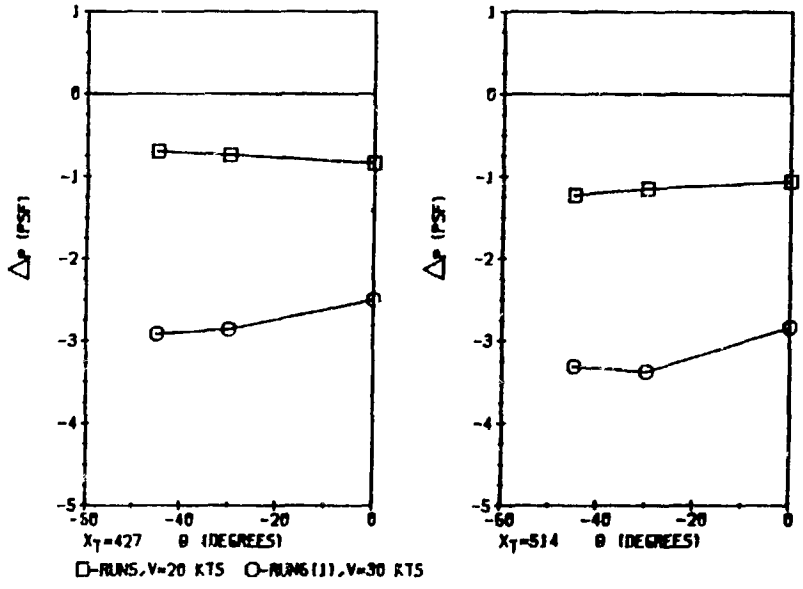












NOMINAL CONFIGURATION

GROUP IX

NOZZLE AZIMUTH ANGLE EFFECTS

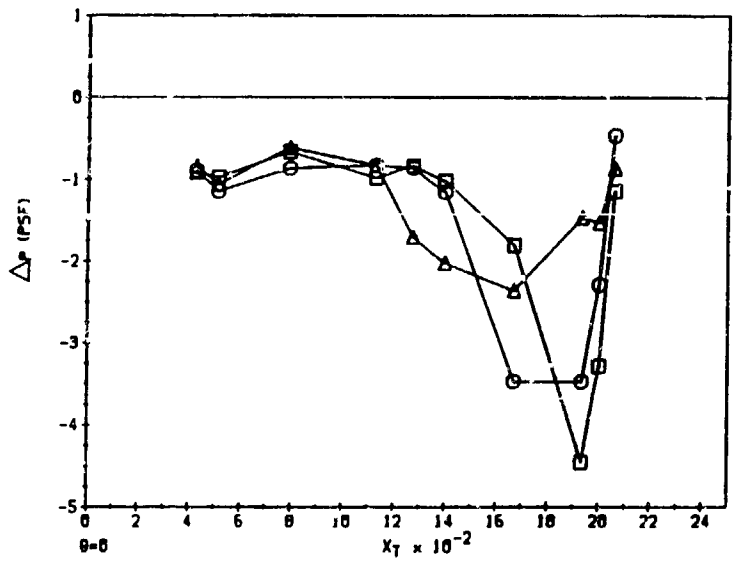
RUNS 1.1, 4 and 5

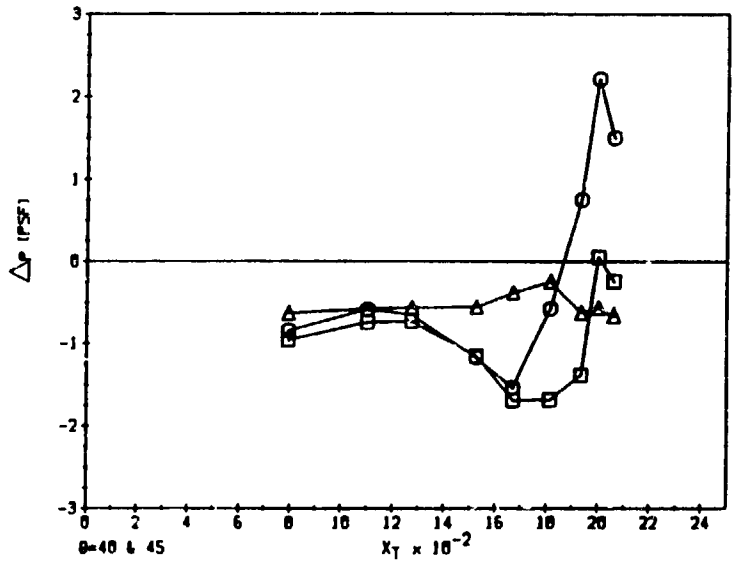
P = 32 psia

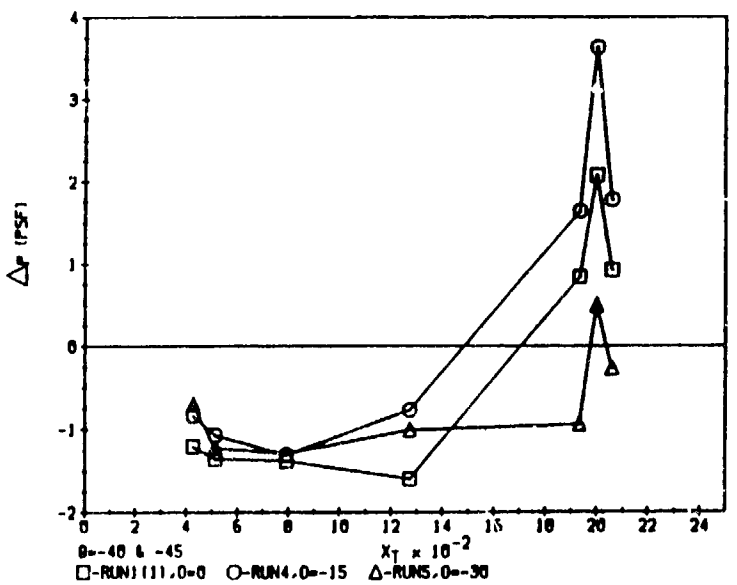
V = 20 KNOTS

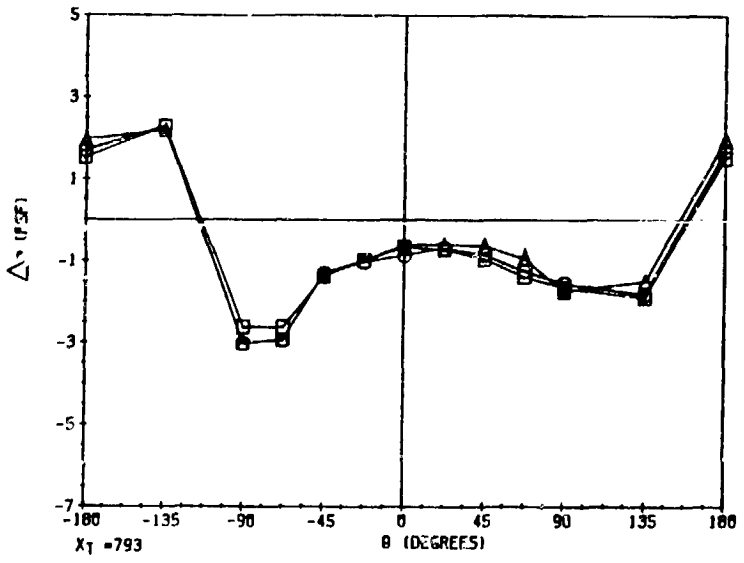
β = 338°

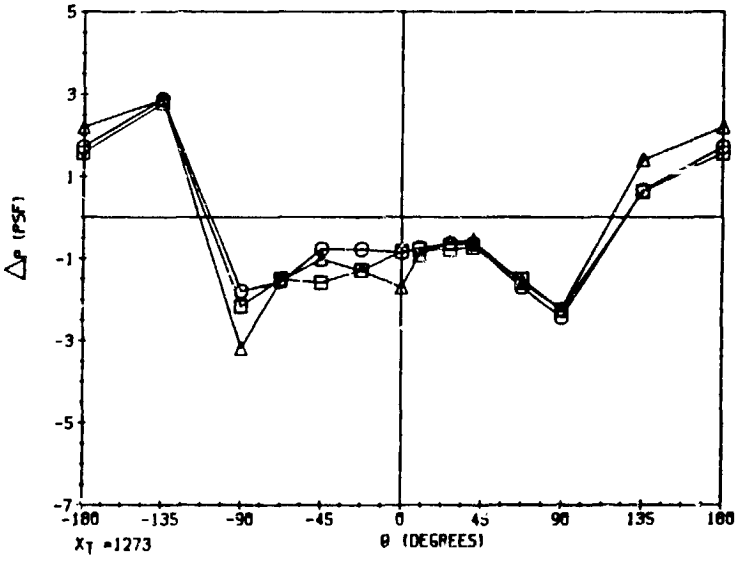
Nominal Nozzles

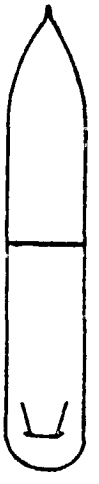


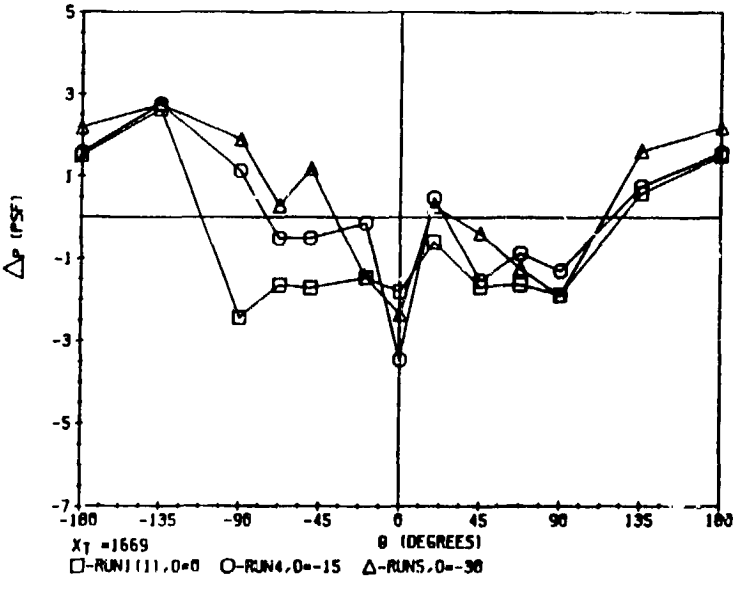


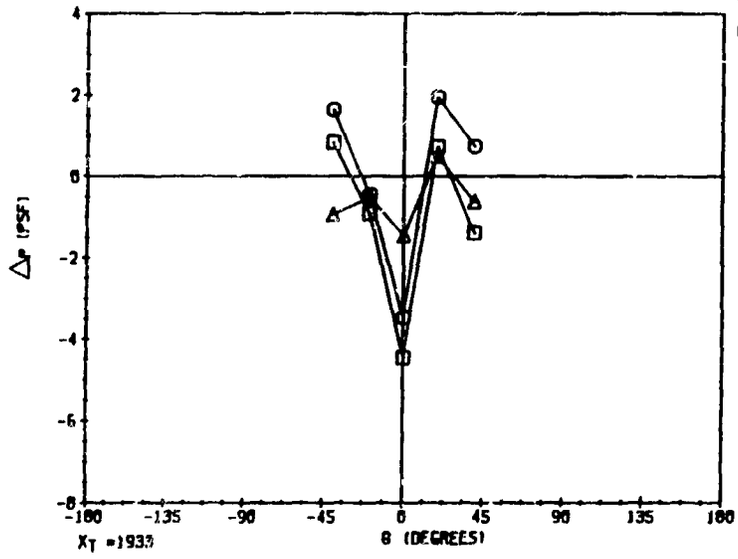


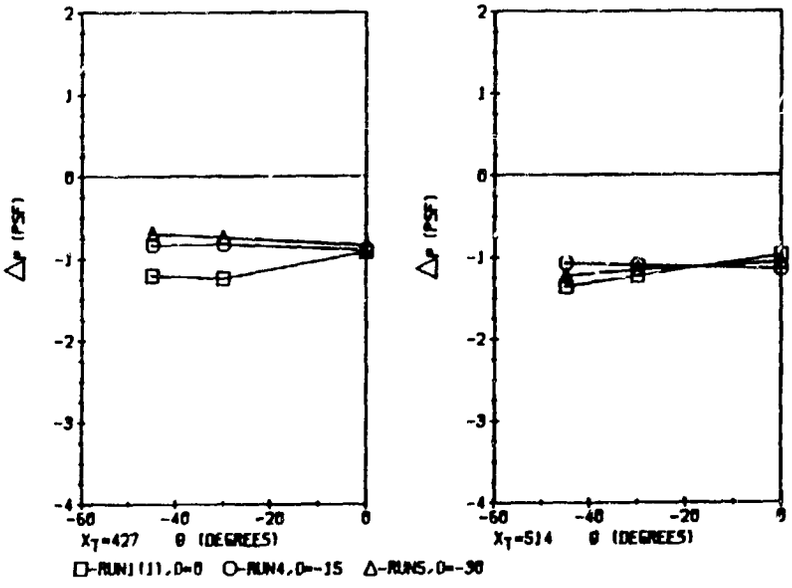












VARIABLE NOZZLE SIZE CONFIGURATION

GROUP X

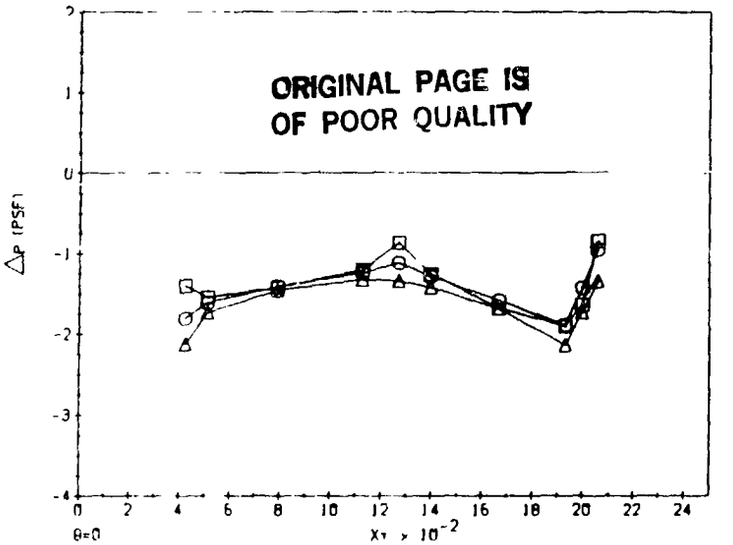
NOZZLE PRESSURE EFFECTS

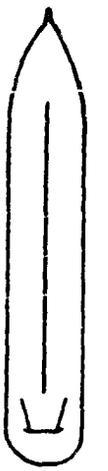
RUNS 28.1, 28.2 and 28.3

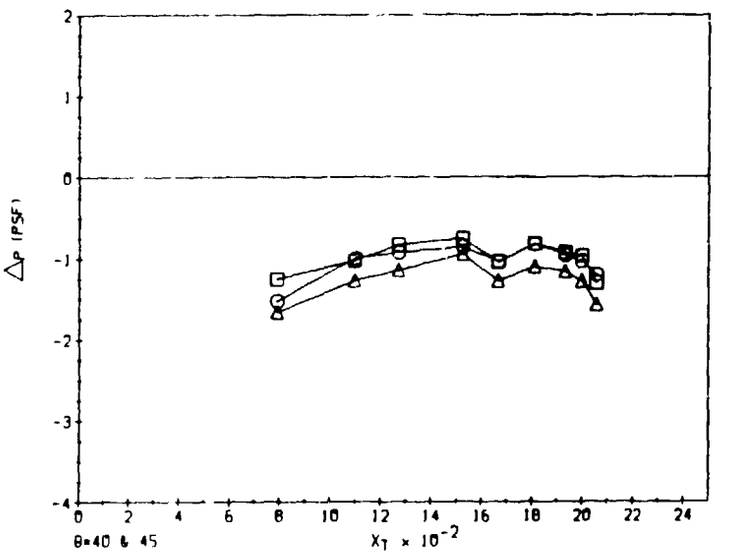
V = 20 KNOTS

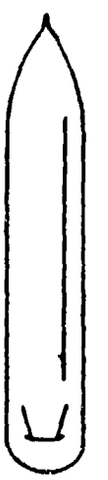
β = 338°

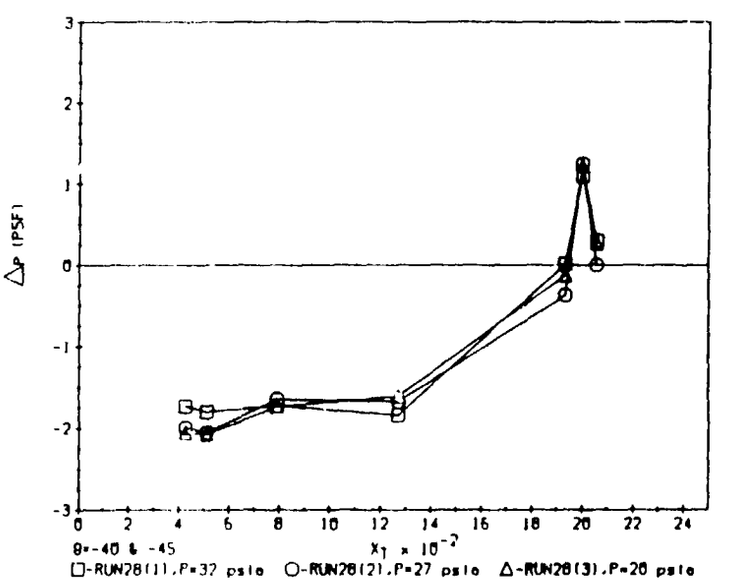
Φ = 0

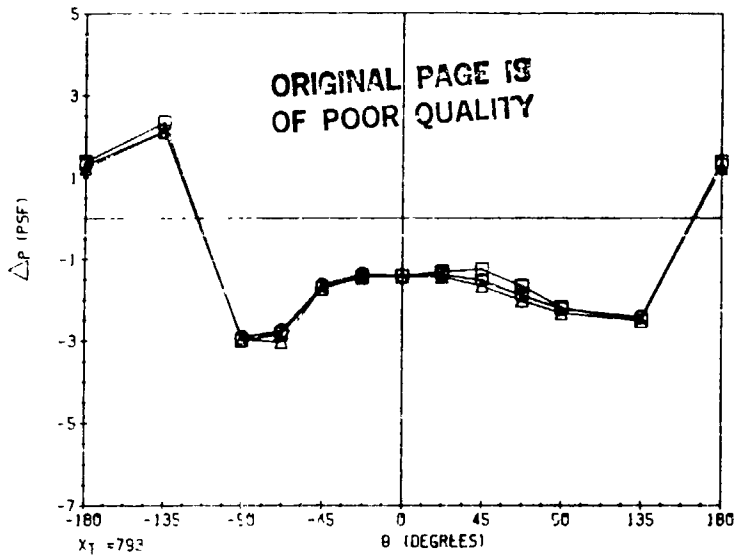


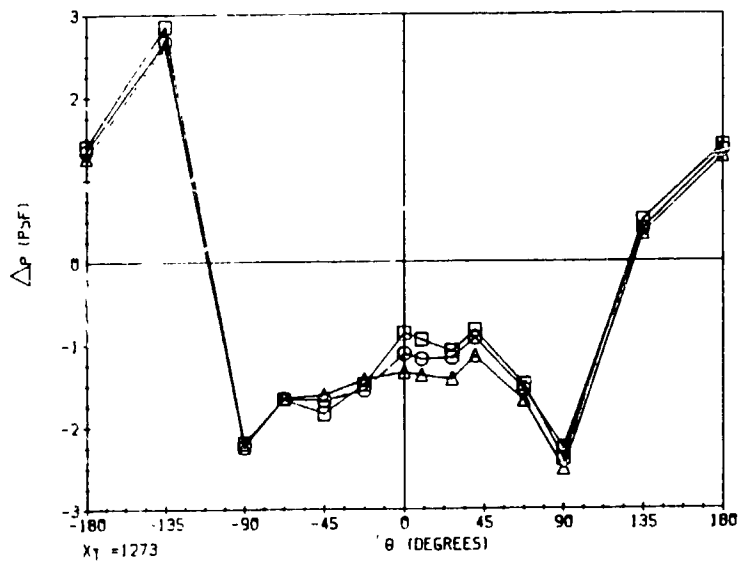


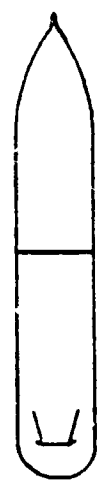


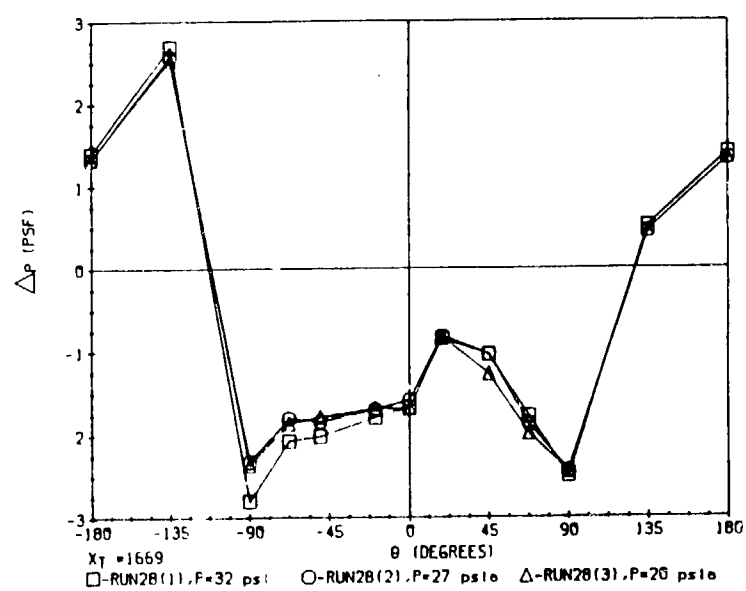


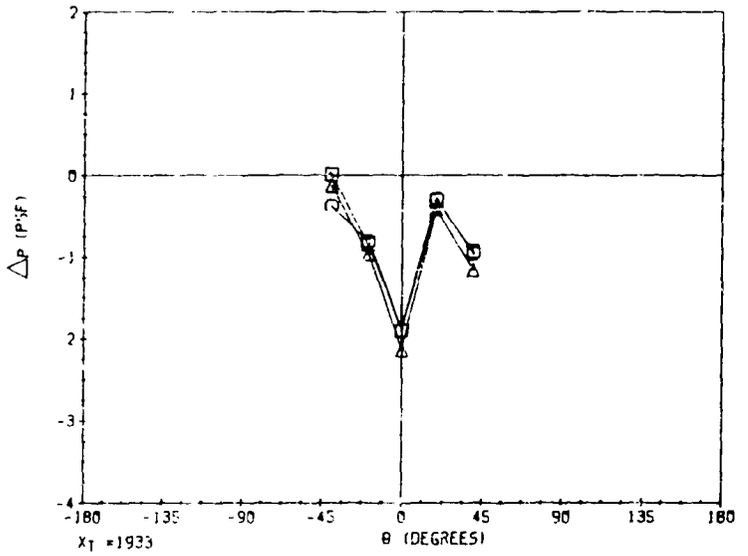


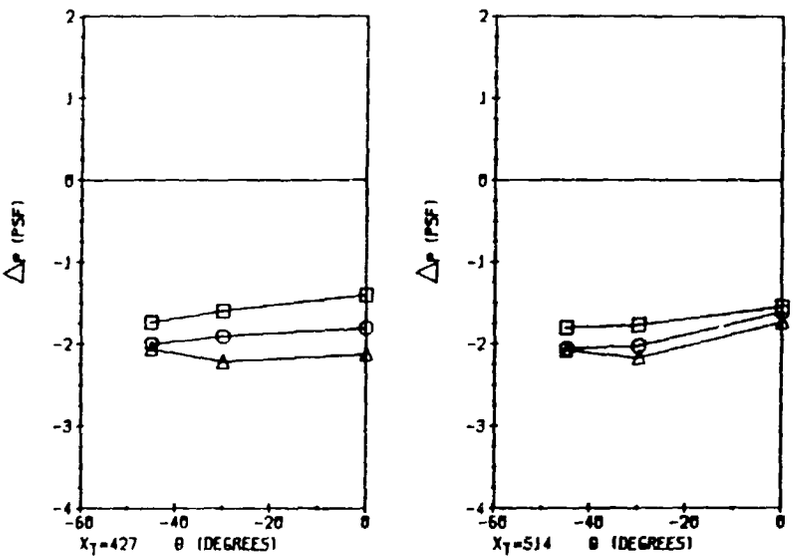












VARIABLE NOZZLE SIZE CONFIGURATION

GROUP XI

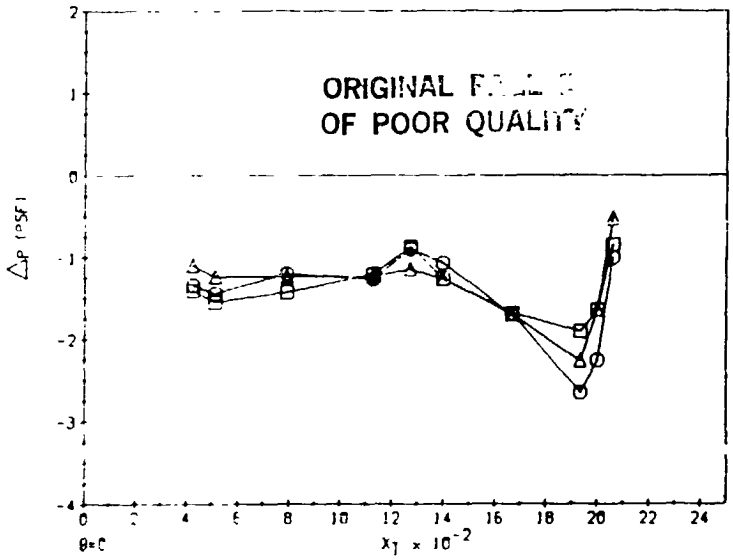
NOZZLE AZIMUTH ANGLE EFFECTS

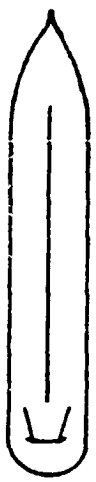
RUNS 28.1, 29.1 and 30.1

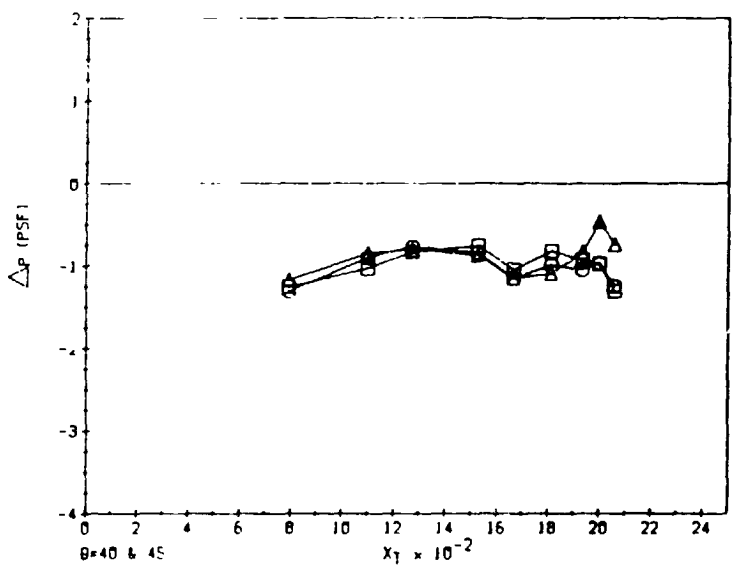
$P = 32$ psia

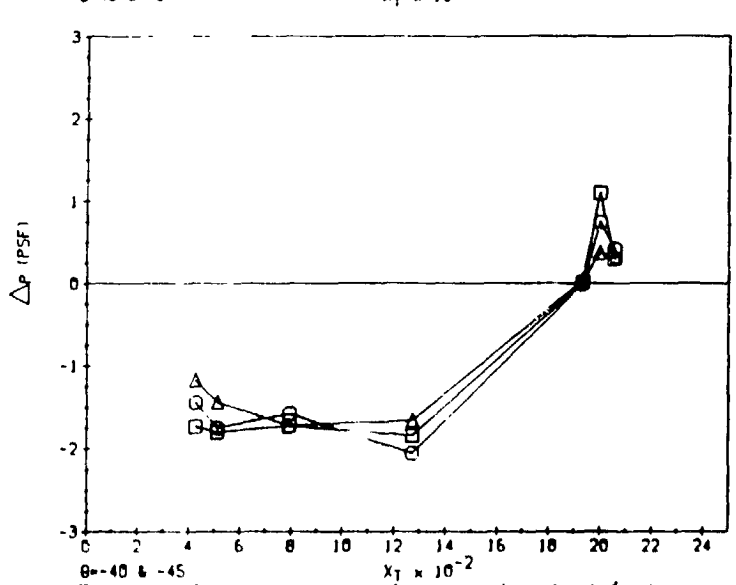
$V = 20$ KNOTS

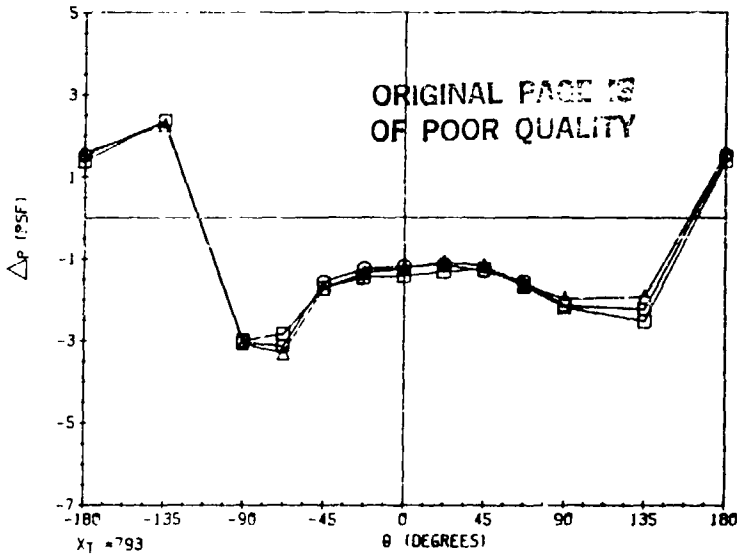
$\beta = 338°$

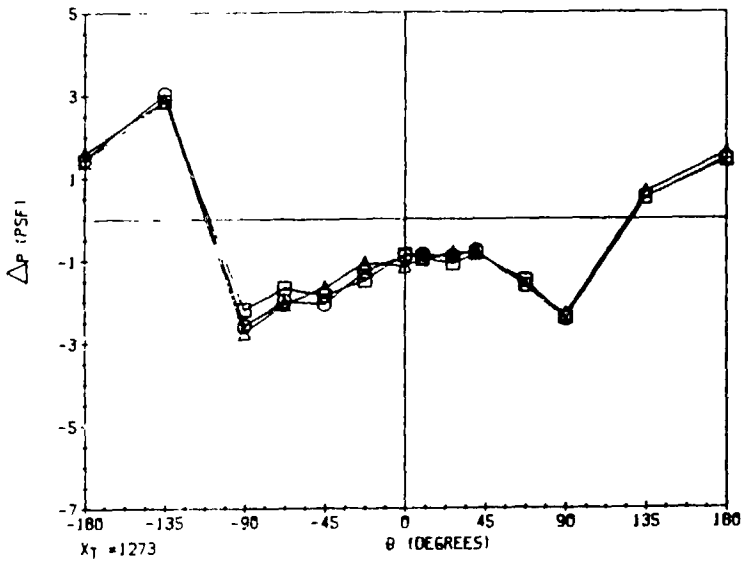


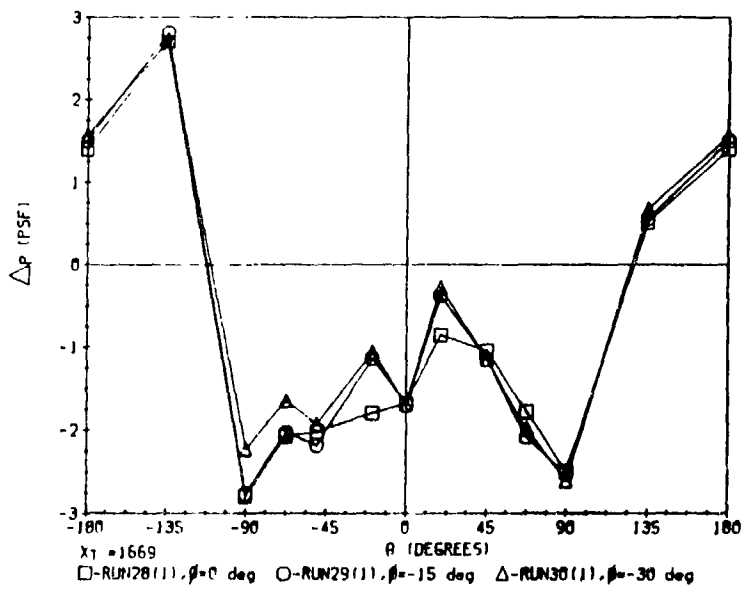


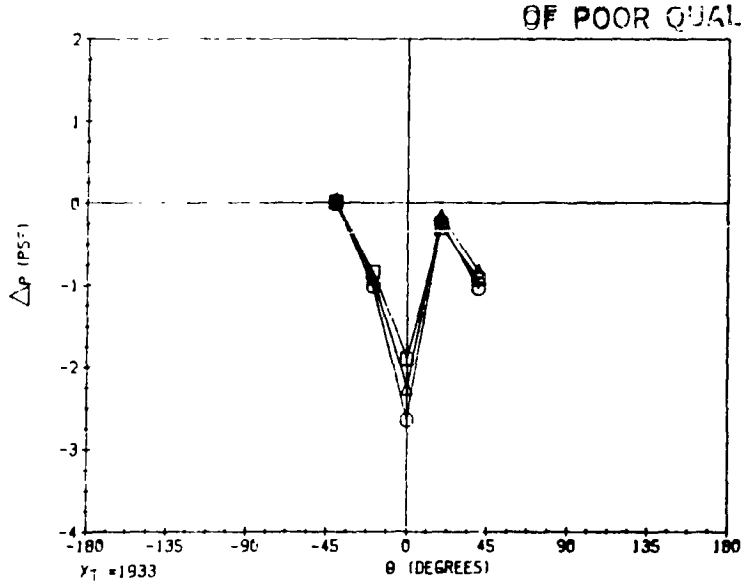


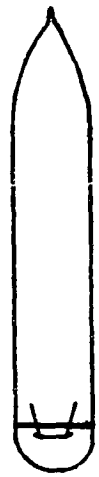


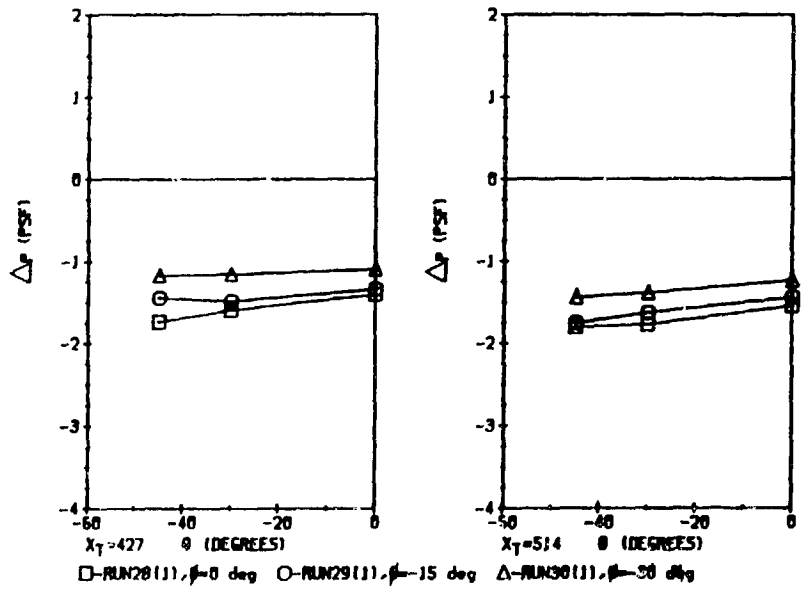


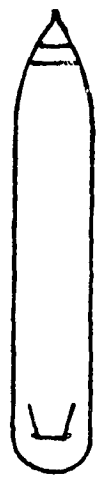












VARIABLE NOZZLE SIZE CONFIGURATION

GROUP XII

INFLUENCE OF NOZZLE PRESSURE ON WIND PENETRATION

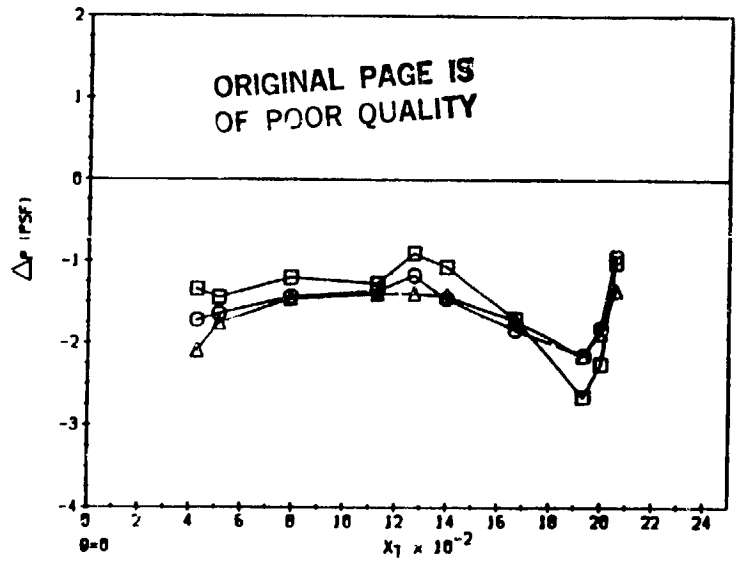
FOR A -15° NOZZLE AZIMUTH ANGLE

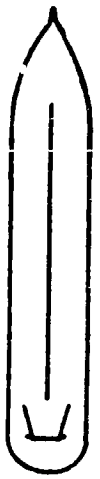
RUNS 29.1, 29.2 and 29.3

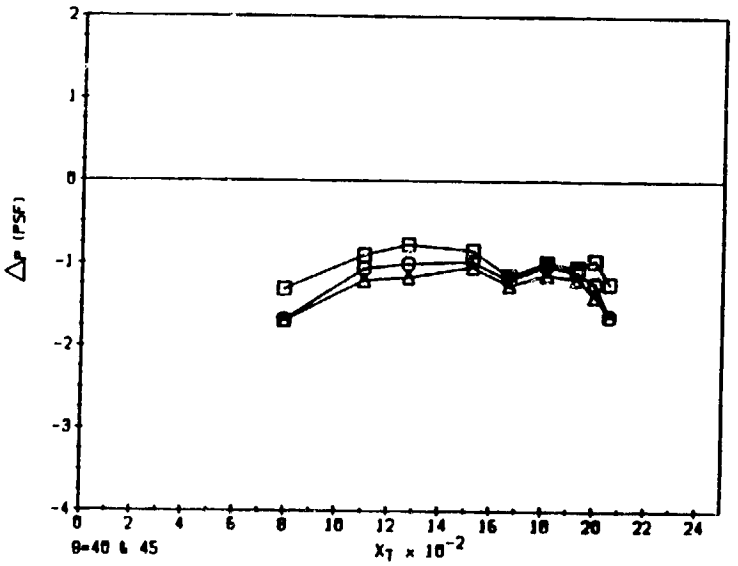
V = 20 KNOTS

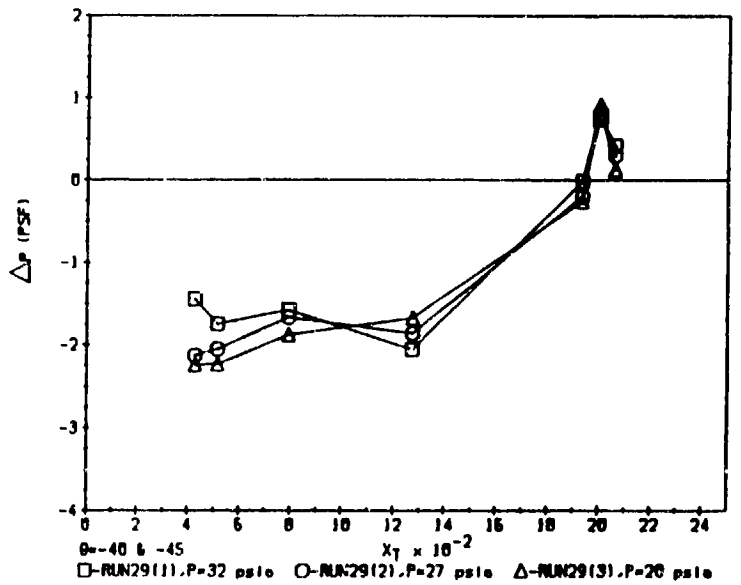
β = 338°

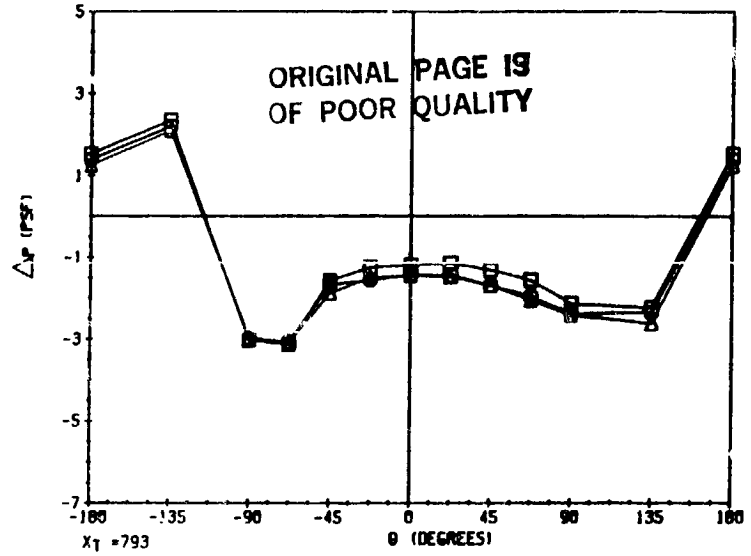
ϕ = -15°

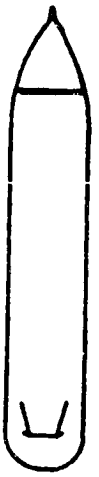


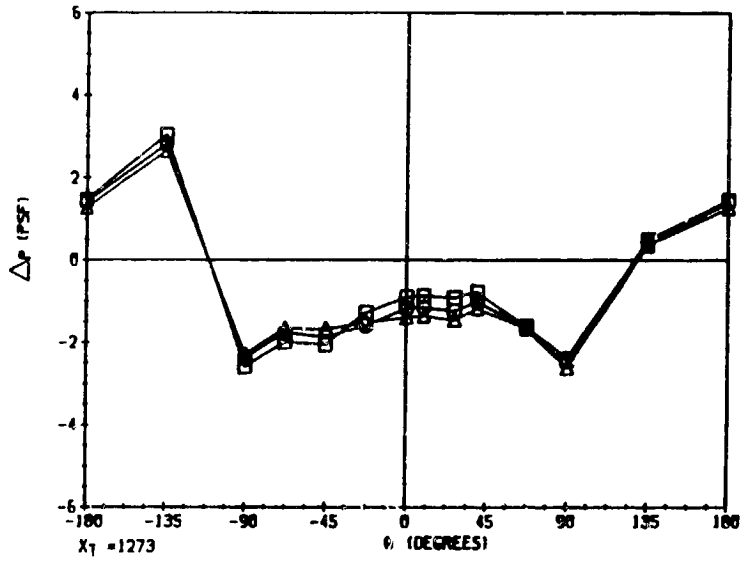


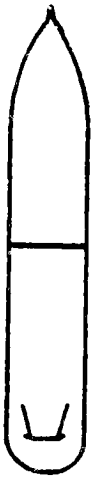


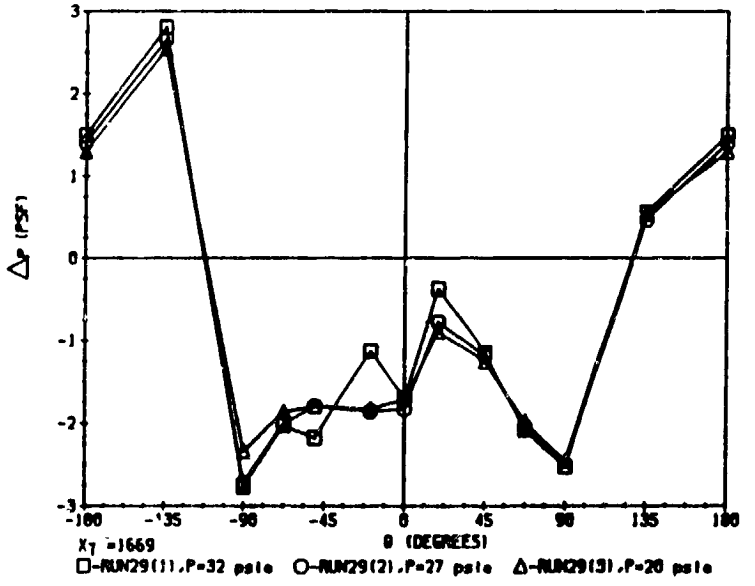


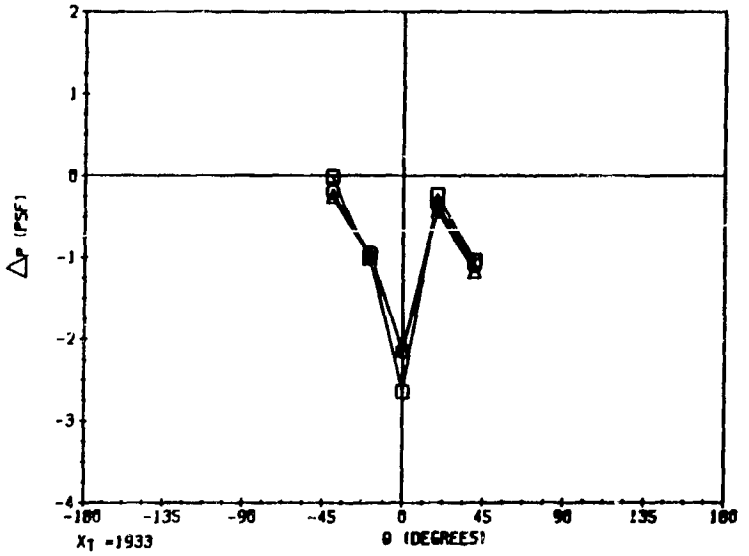


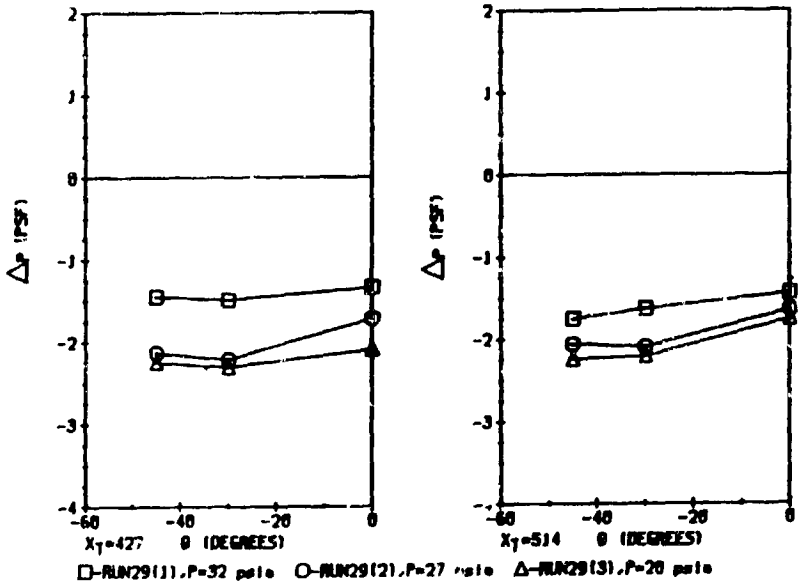












VARIABLE NOZZLE SIZE CONFIGURATION

GROUP XIII

INFLUENCE OF NOZZLE PRESSURE ON WIND PENETRATION

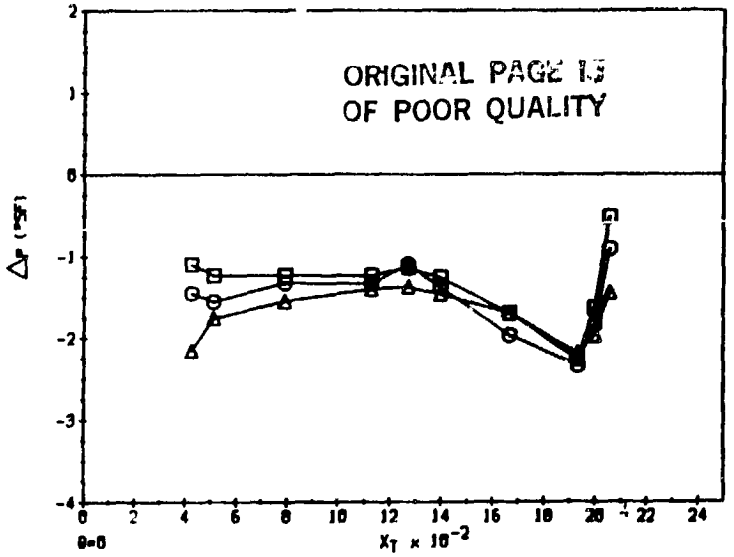
FOR A -30° NOZZLE AZIMUTH ANGLE

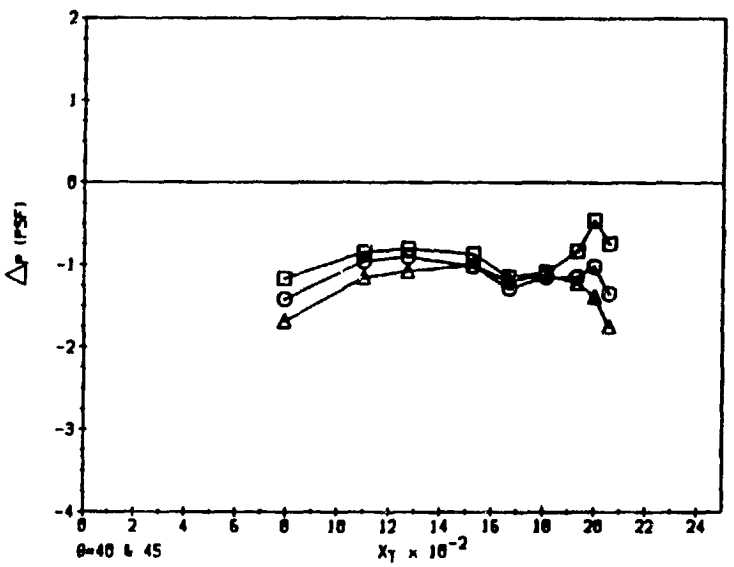
RUNS 30.1, 30.2 and 30.3

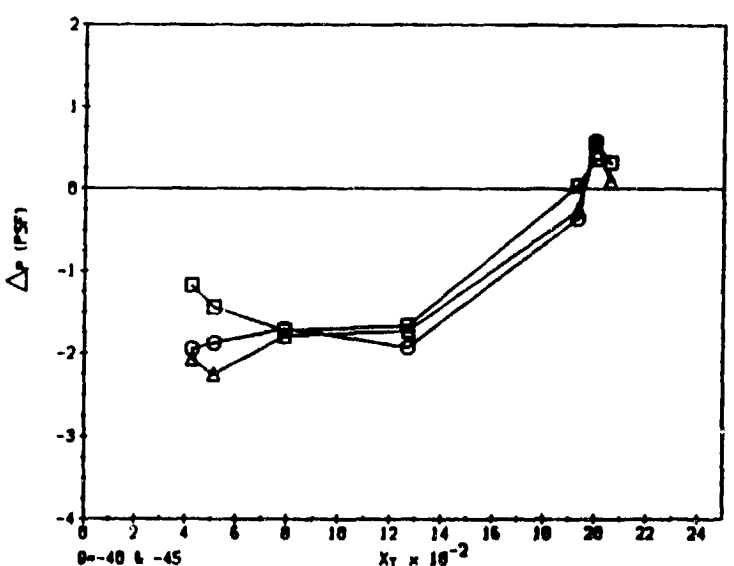
V = 20 KNOTS

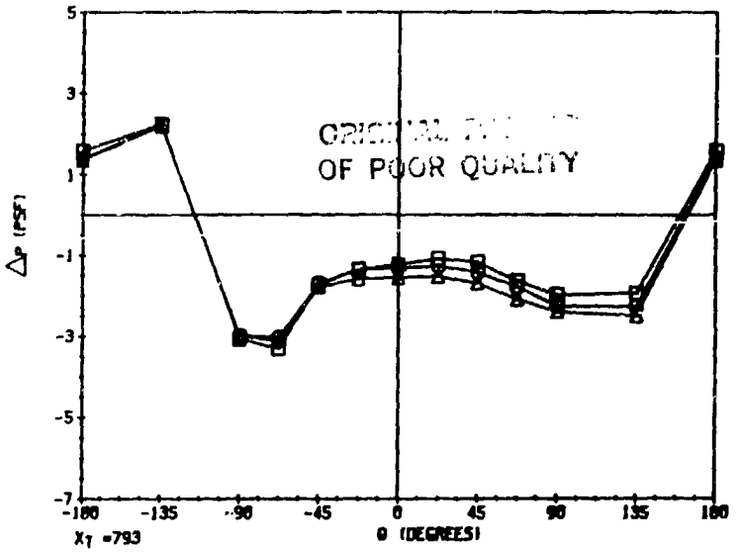
β = 338°

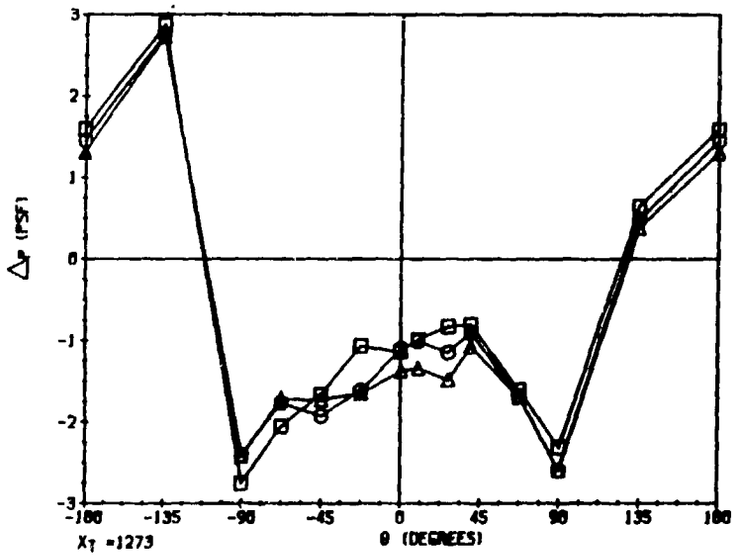
ϕ = -30°

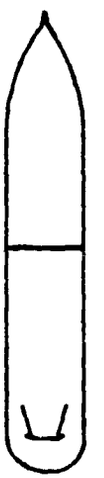


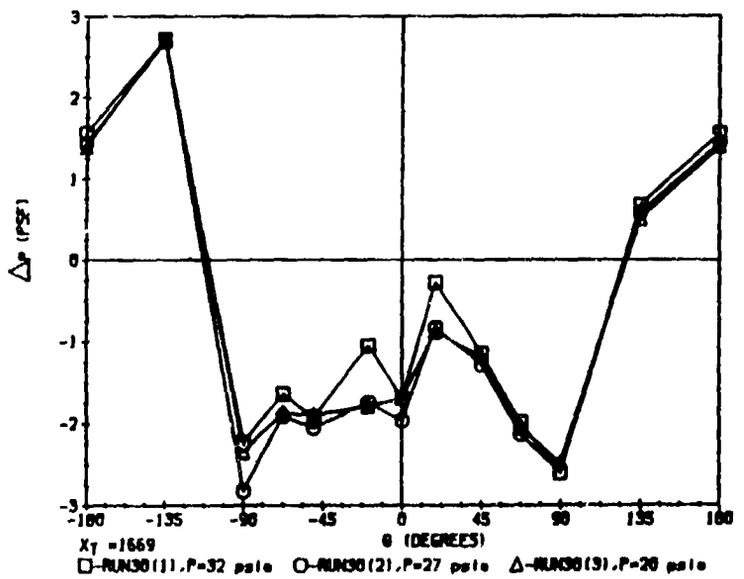


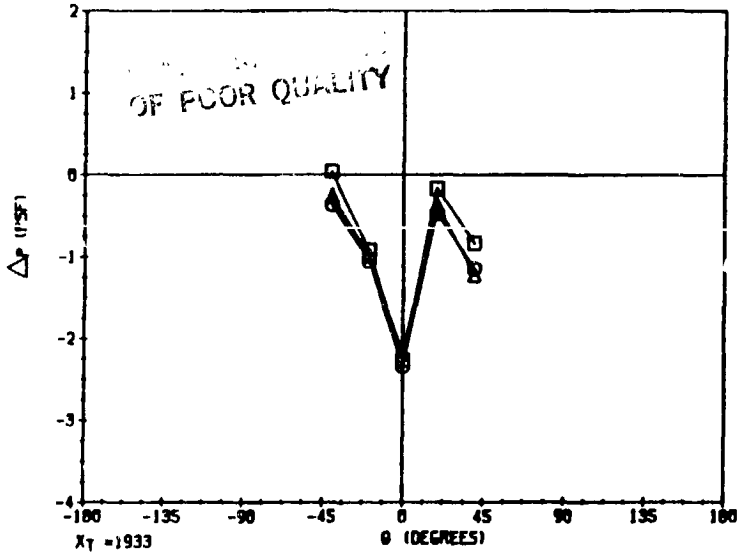


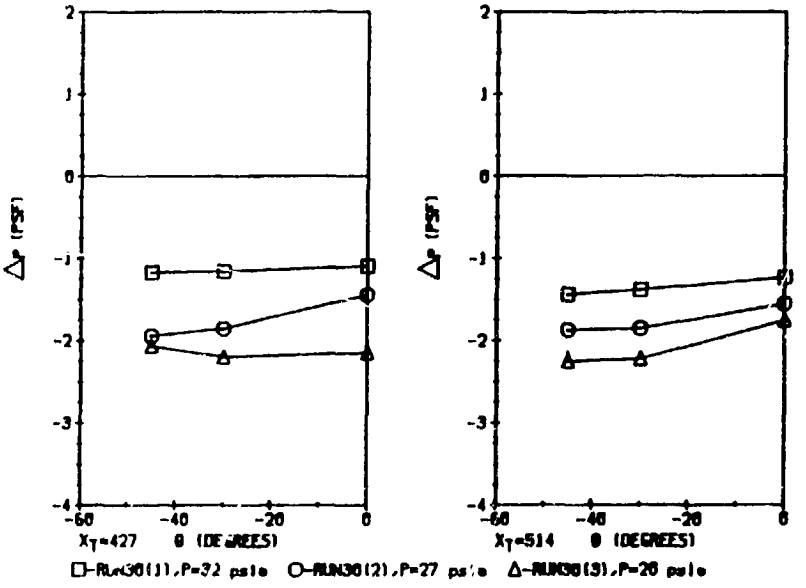












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

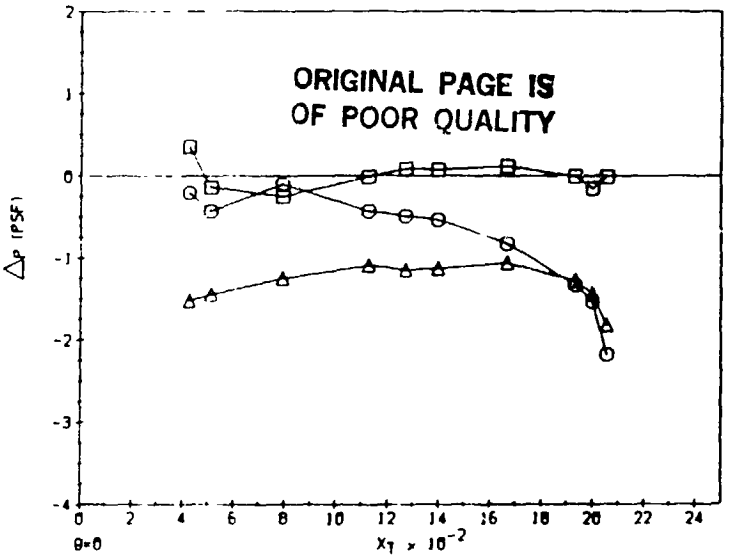
GROUP XIV

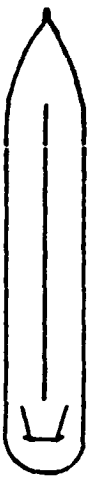
WIND VELOCITY EFFECTS AT 0°, LOW FLOWRATE

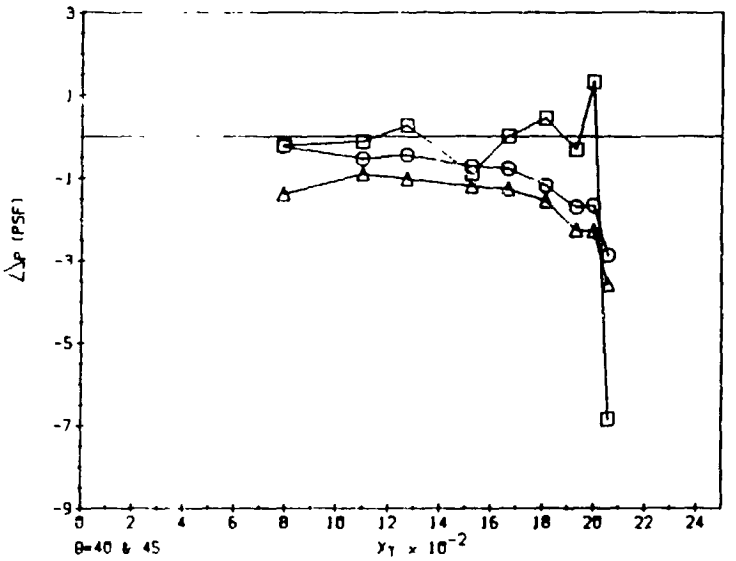
RUNS 33.1 and 33.2

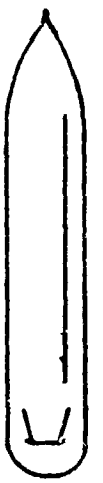
$\beta = 0°$

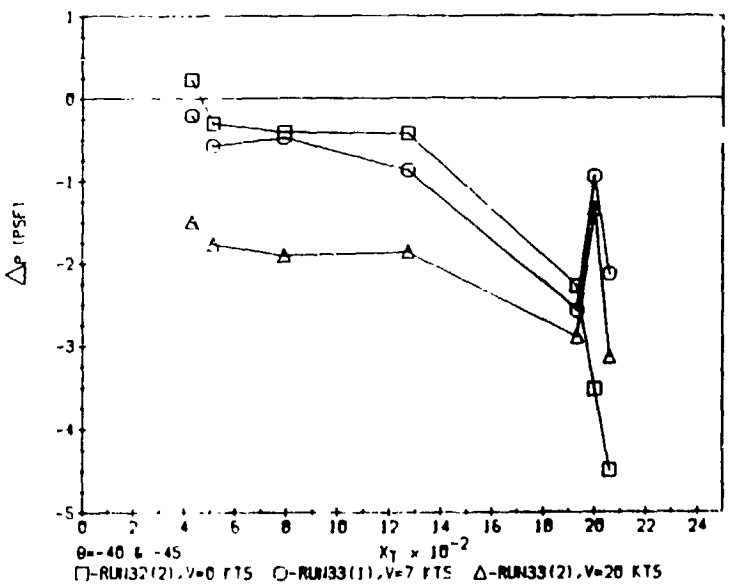
Low Flowrate

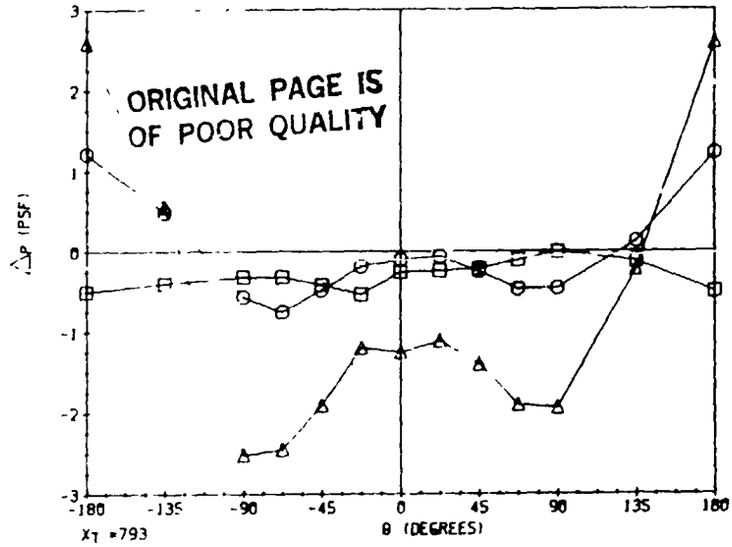


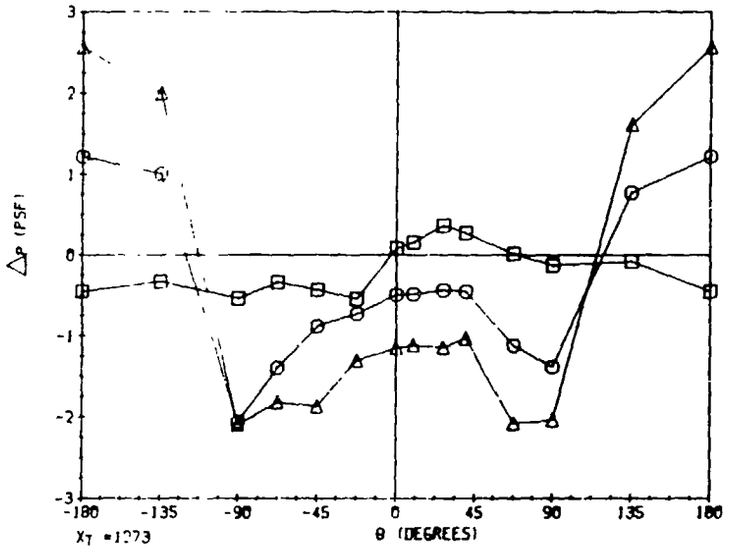


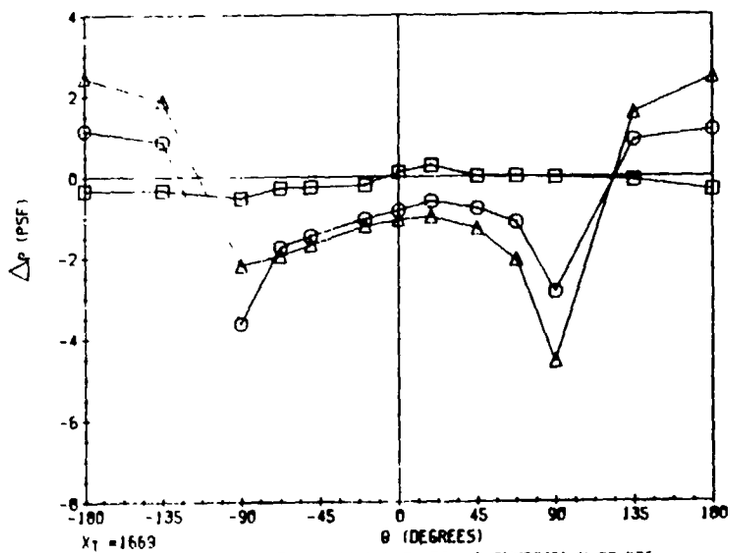


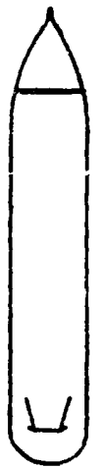


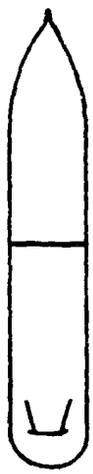


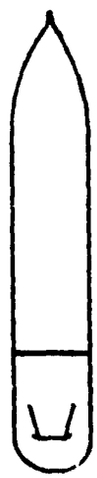


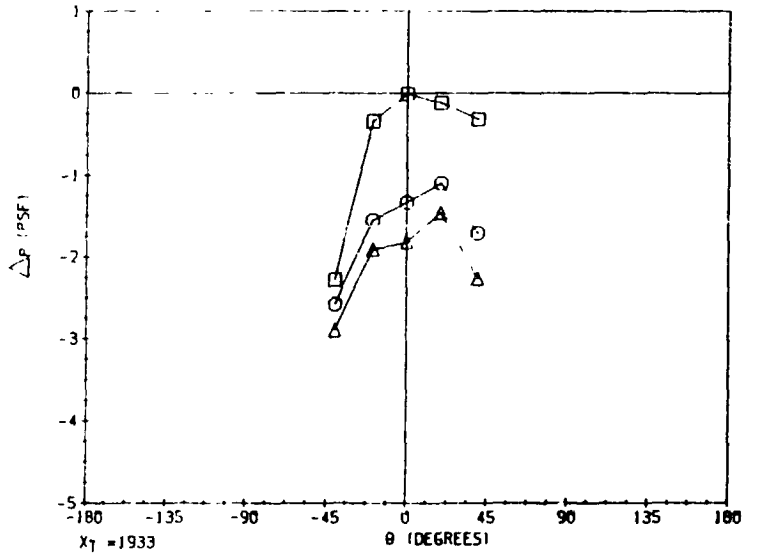


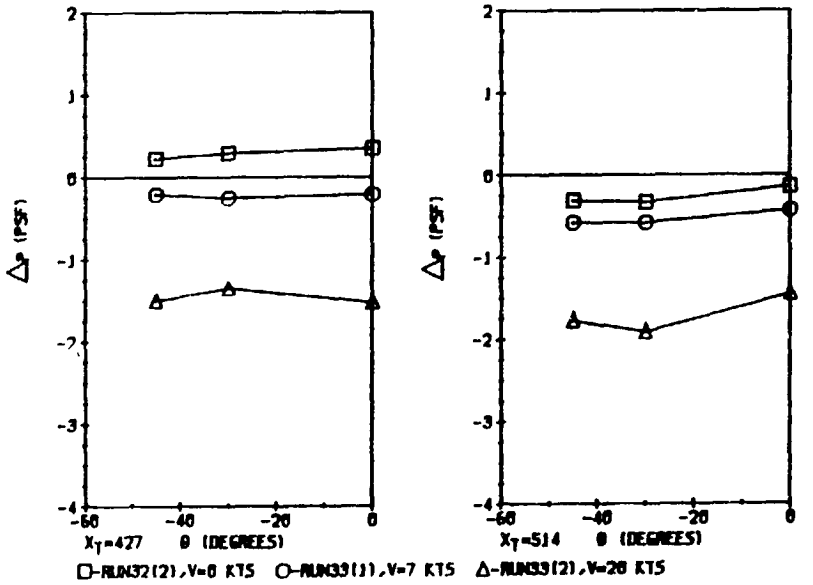












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

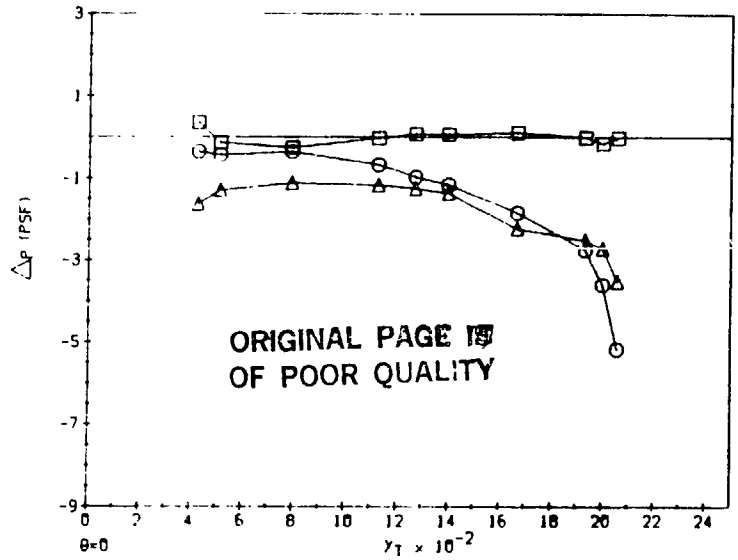
GROUP XV

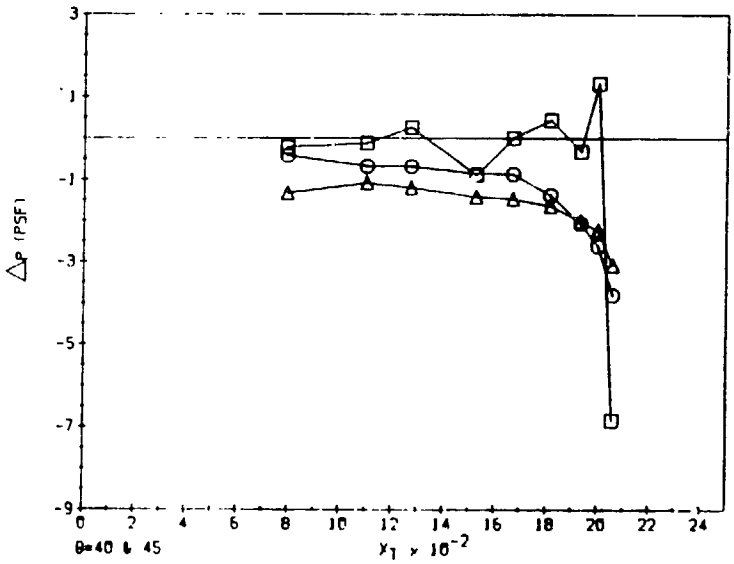
WIND VELOCITY EFFECTS AT 338°, LOW FLOWRATE

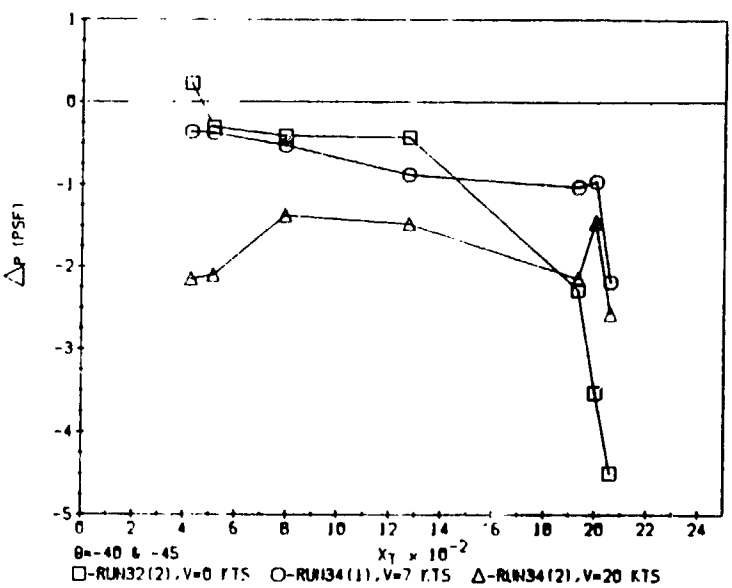
RUNS 34.1 and 34.2

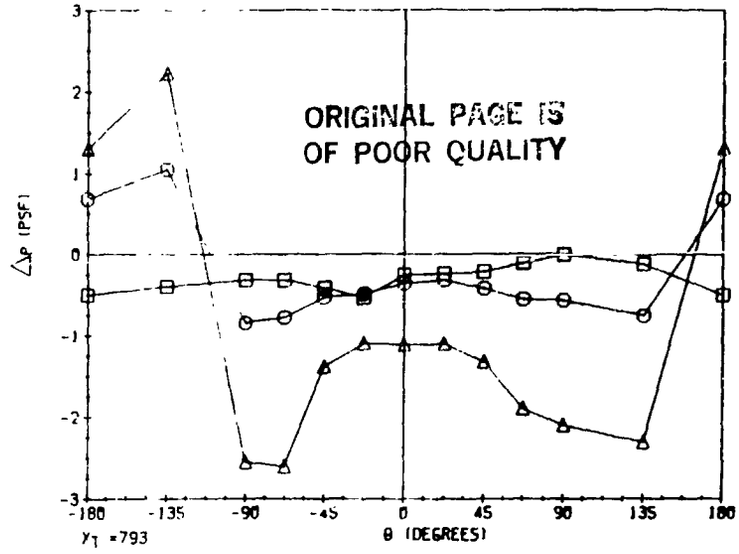
$\beta = 338°$

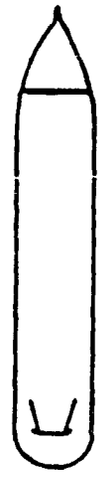
Low Flowrate

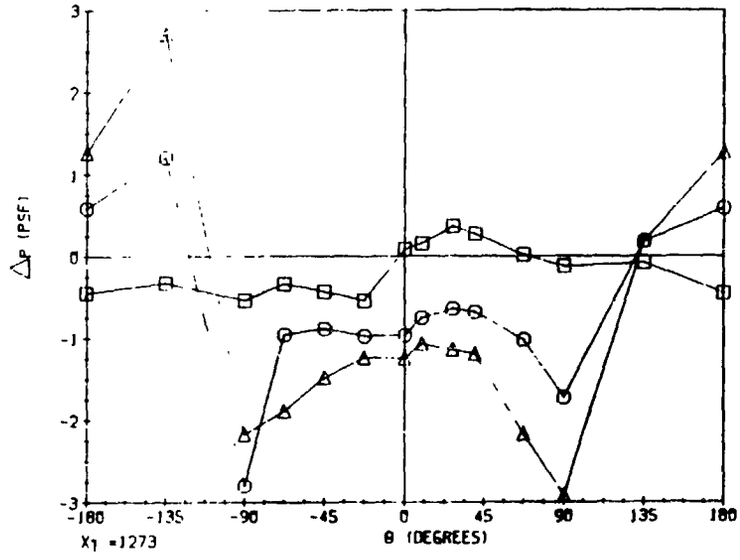


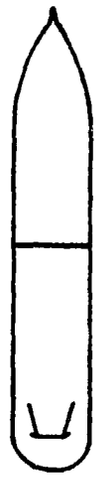


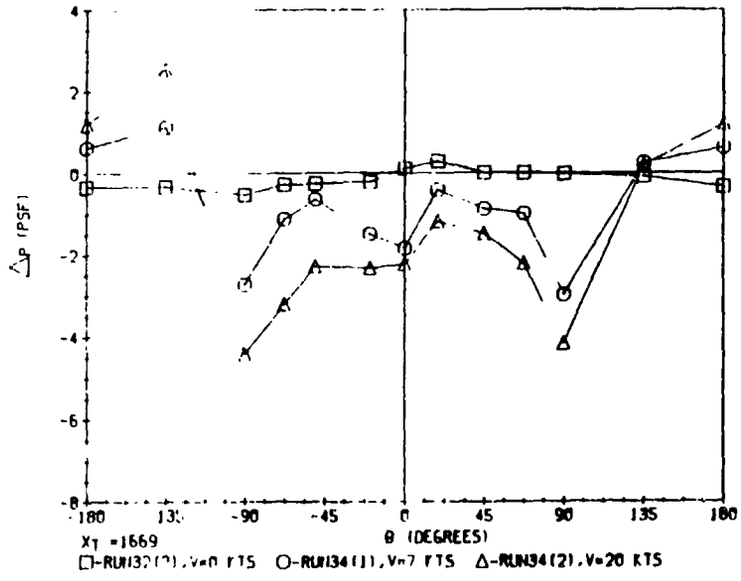


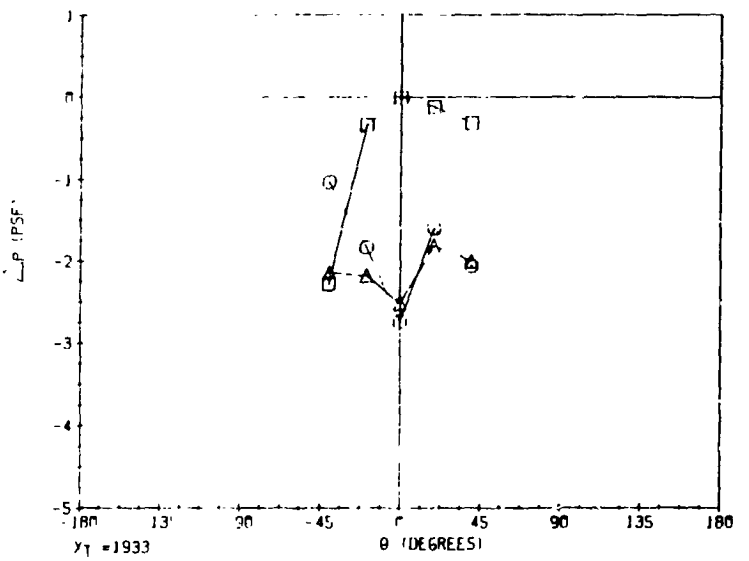


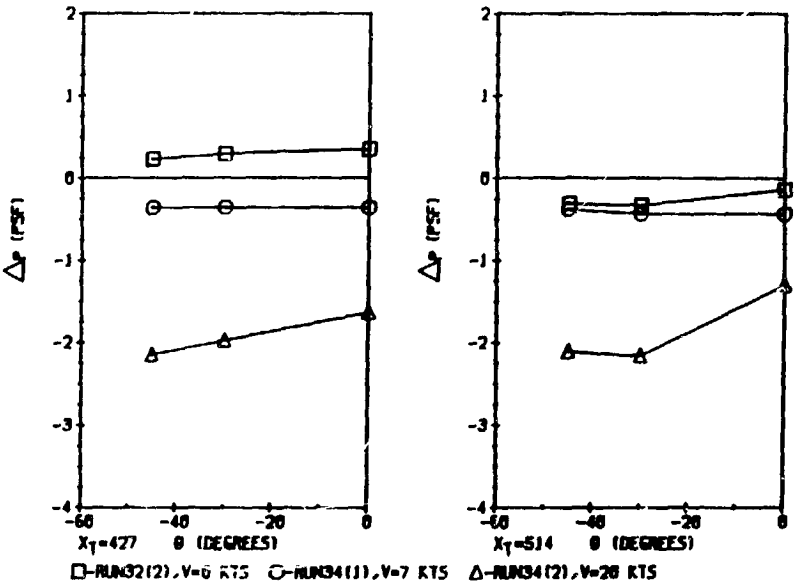












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

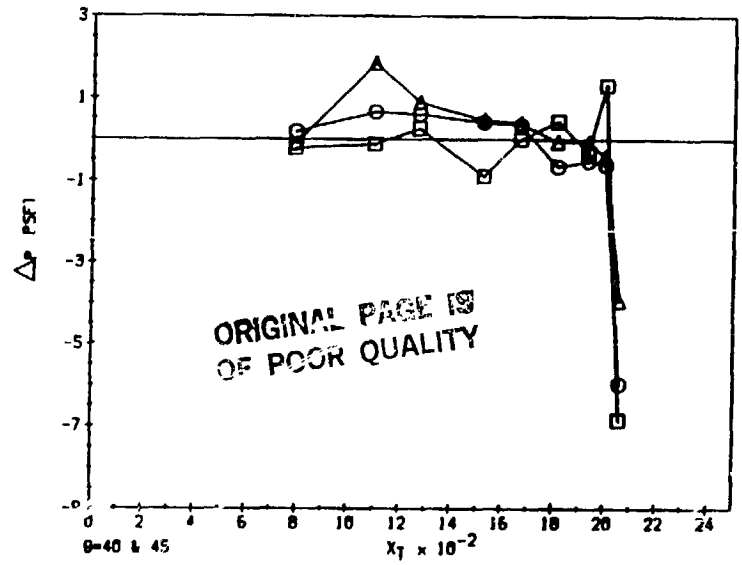
GROUP XVI

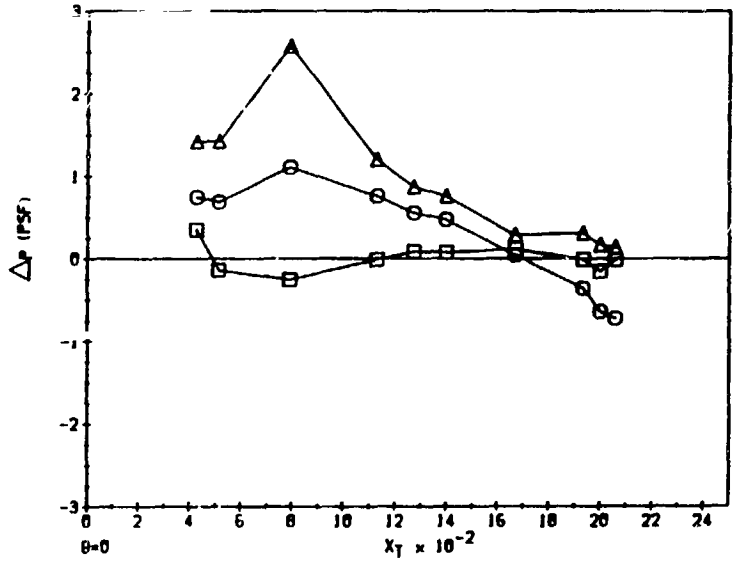
WIND VELOCITY EFFECTS AT 180°, LOW FLOWRATE

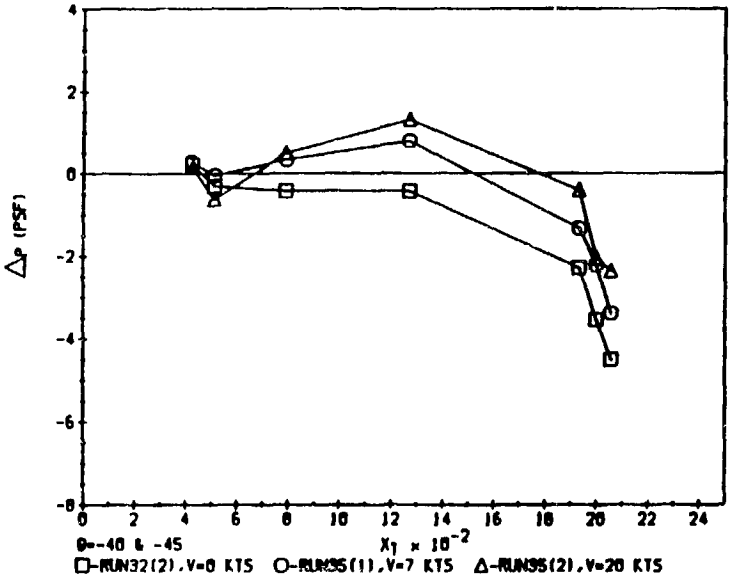
RUNS 35.1 and 35.2

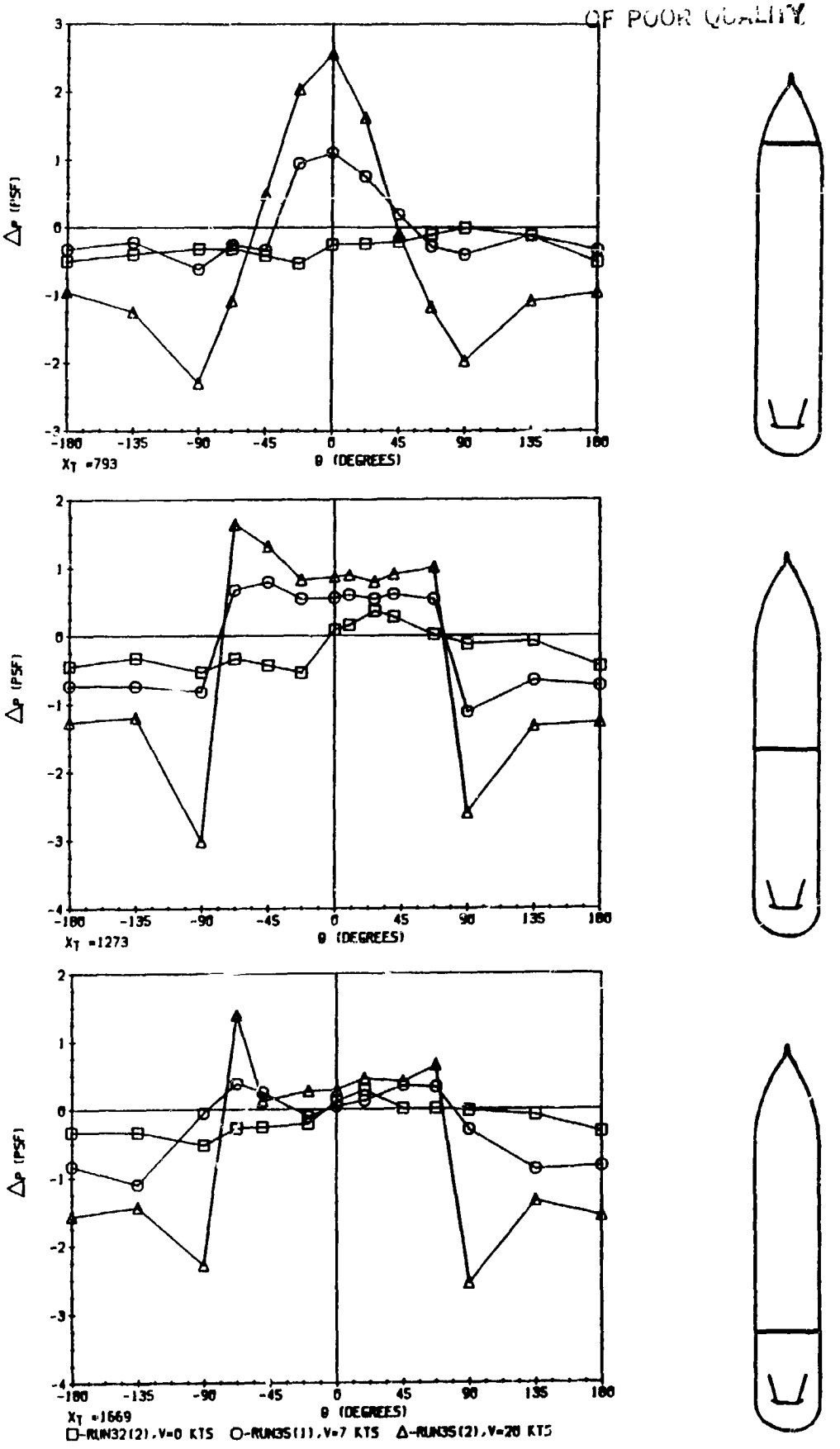
$\beta = 180°$

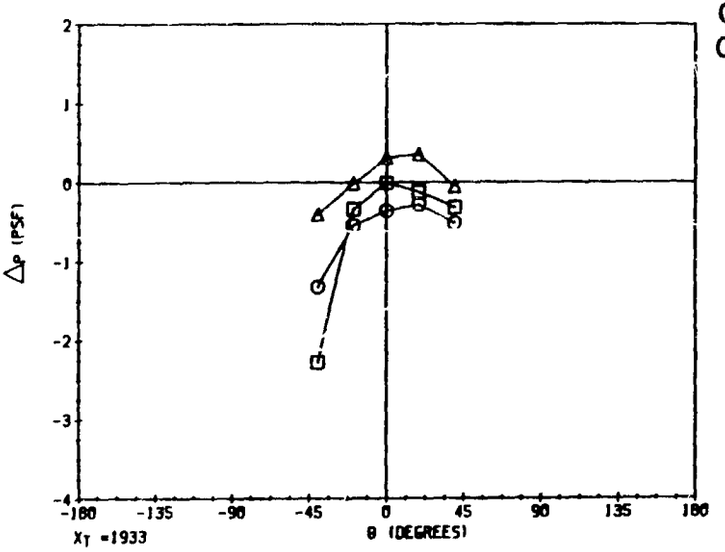
Low Flowrate

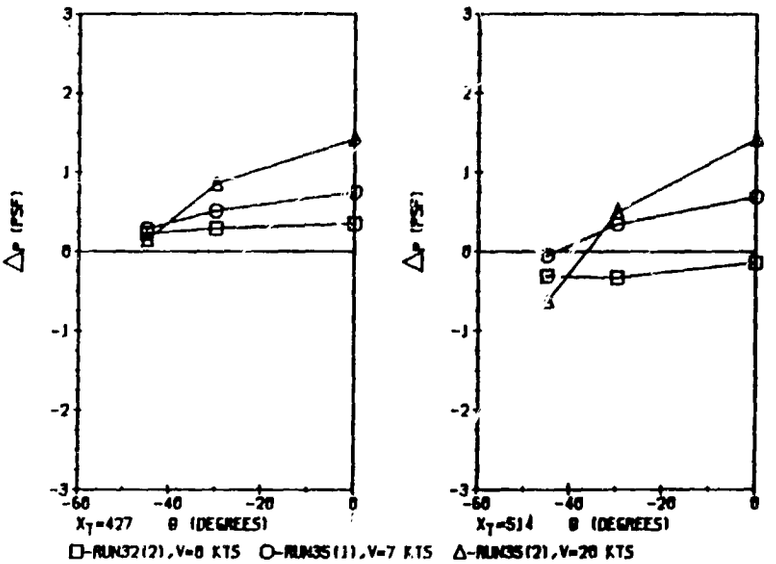


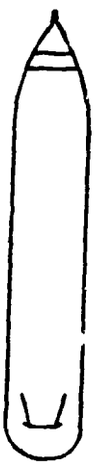












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

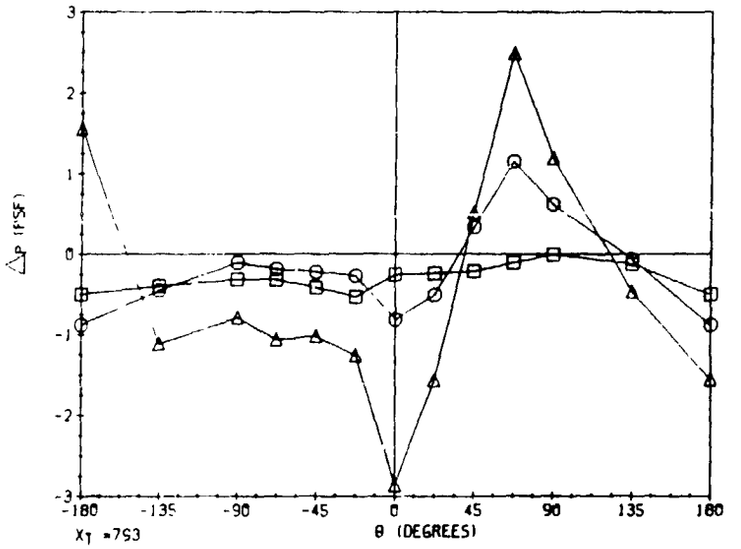
GROUP XVII

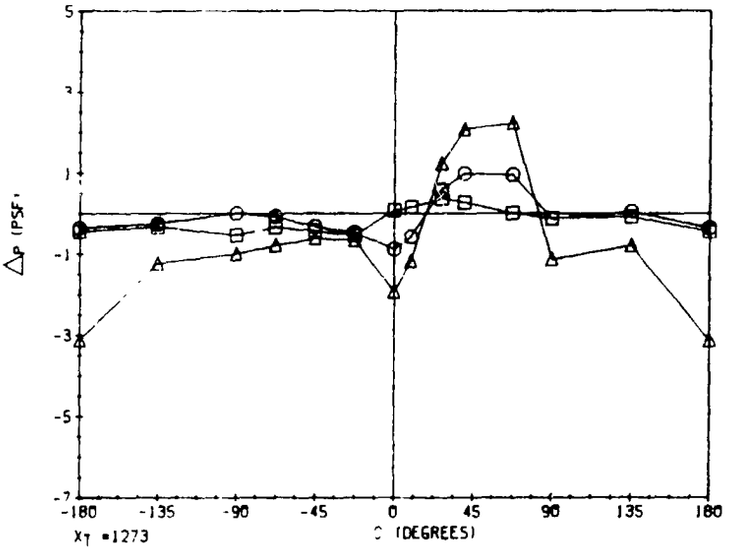
WIND VELOCITY EFFECTS AT 90°, LOW FLOWRATE

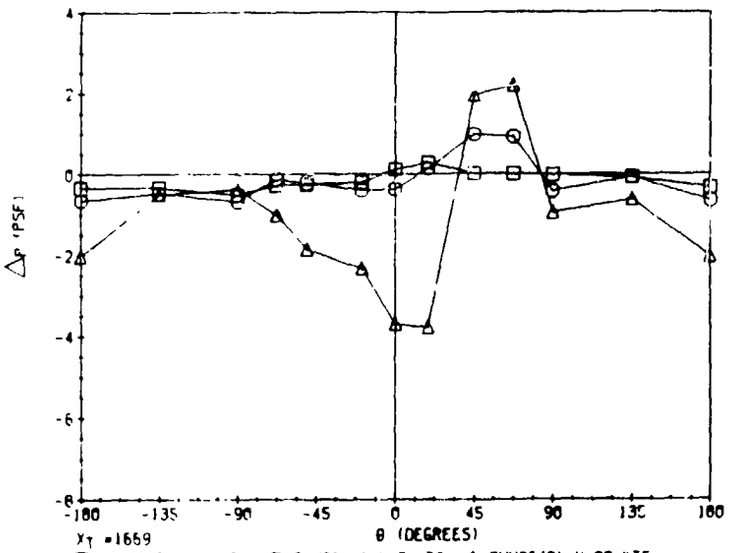
RUNS 36.1 and 36.2

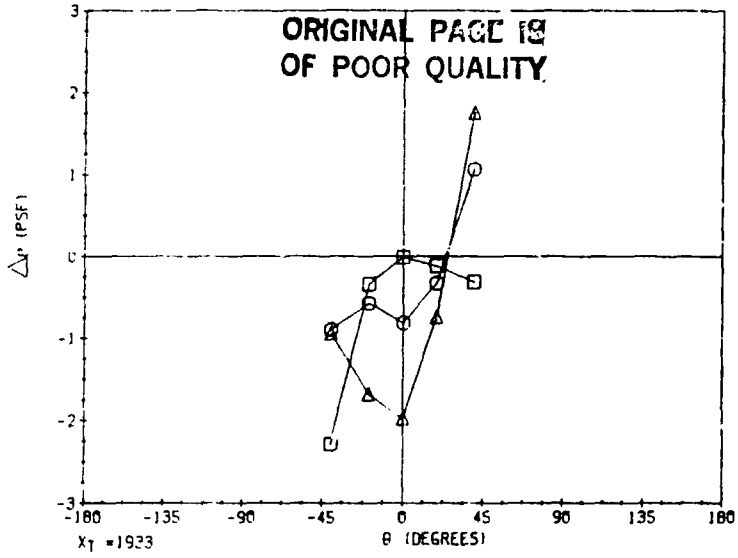
$\beta = 90°$

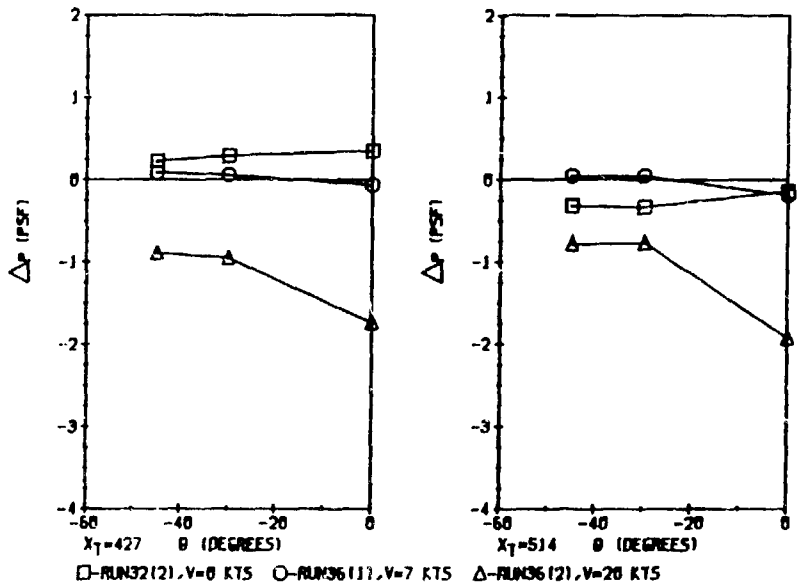
Low Flowrate











MARSHALL SPACE FLIGHT CENTER CONFIGURATION

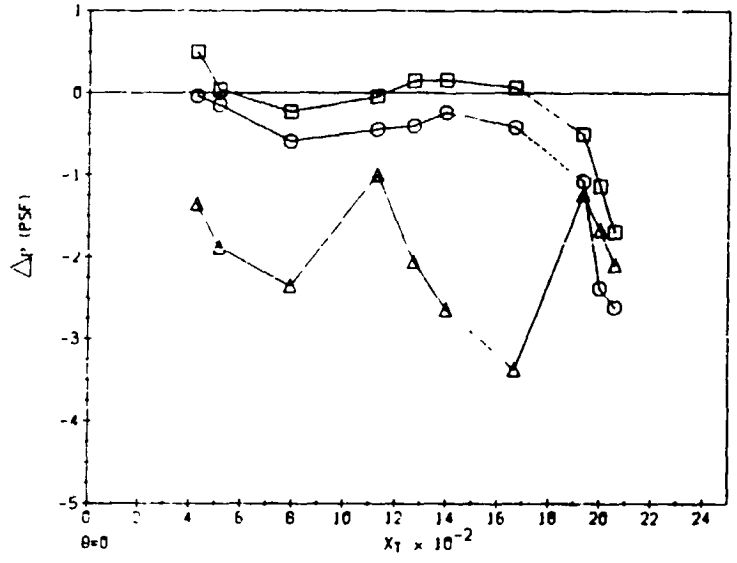
GROUP XVIII

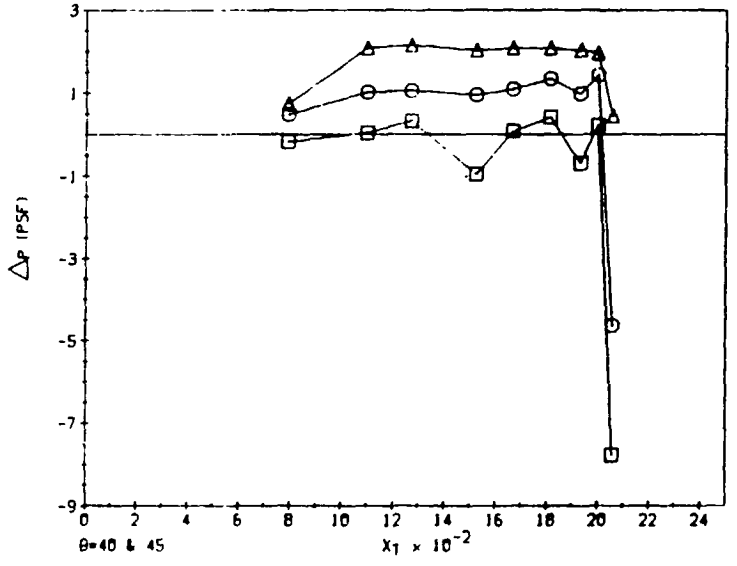
WIND VELOCITY EFFECTS AT 90°, HIGH FLOWRATE

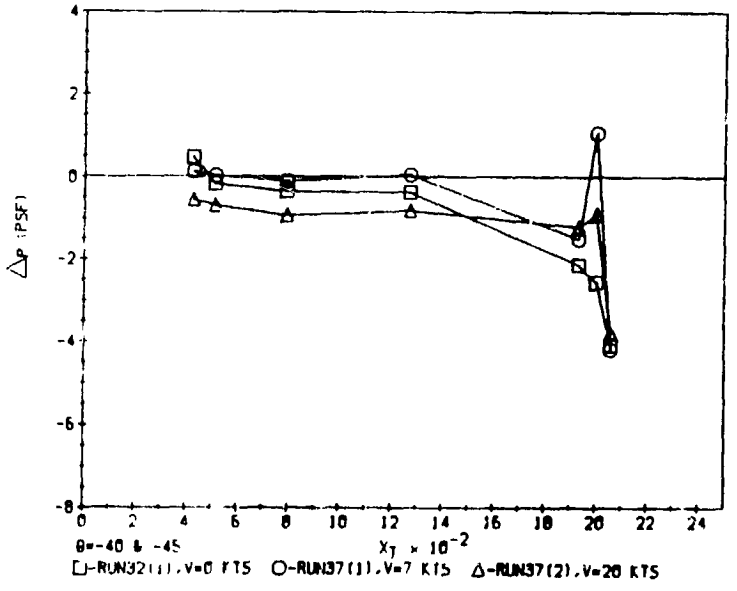
RUNS 37.1 and 37.2

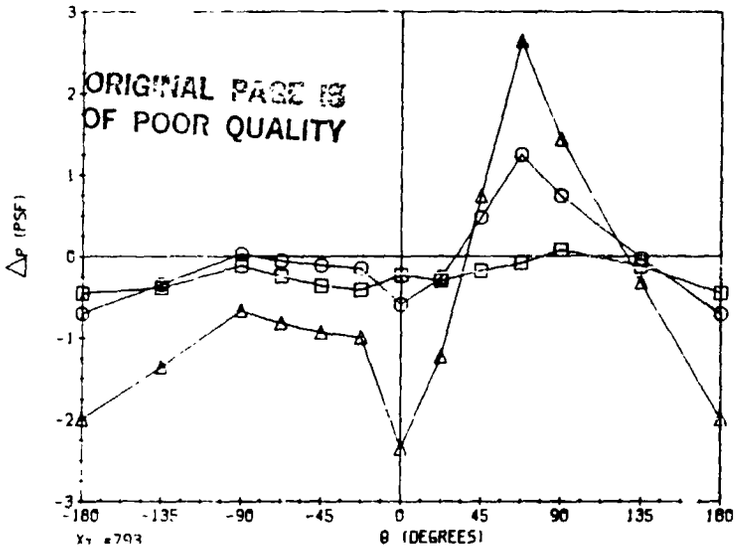
$\beta = 90°$

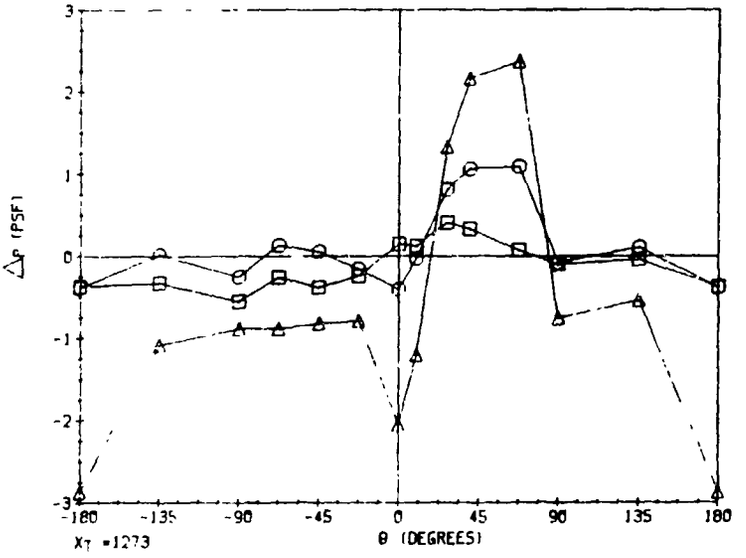
High Flowrate

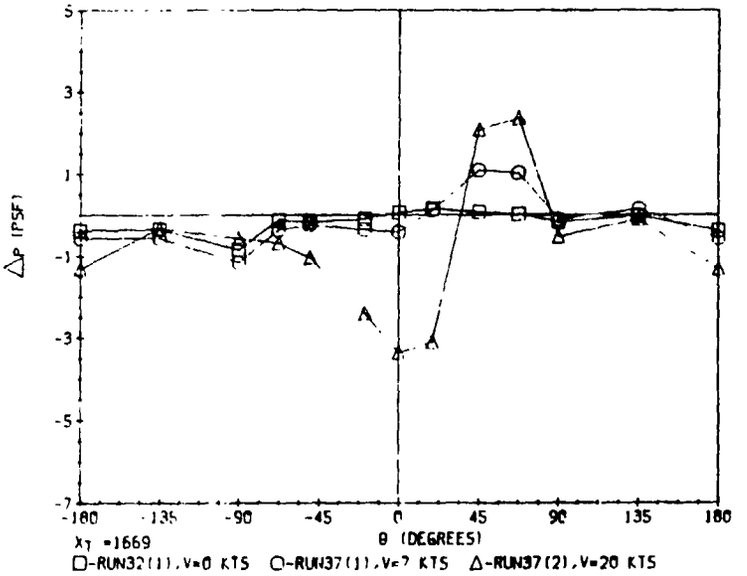


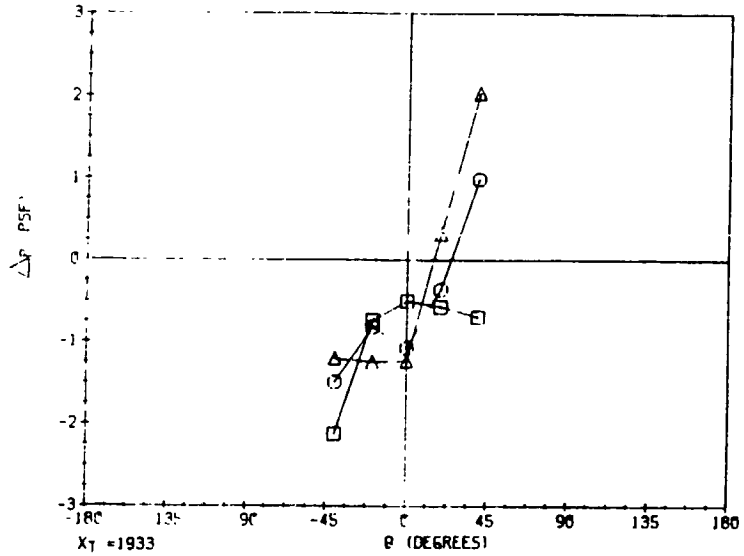


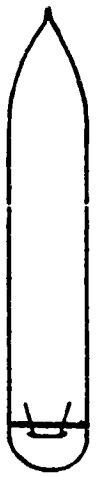


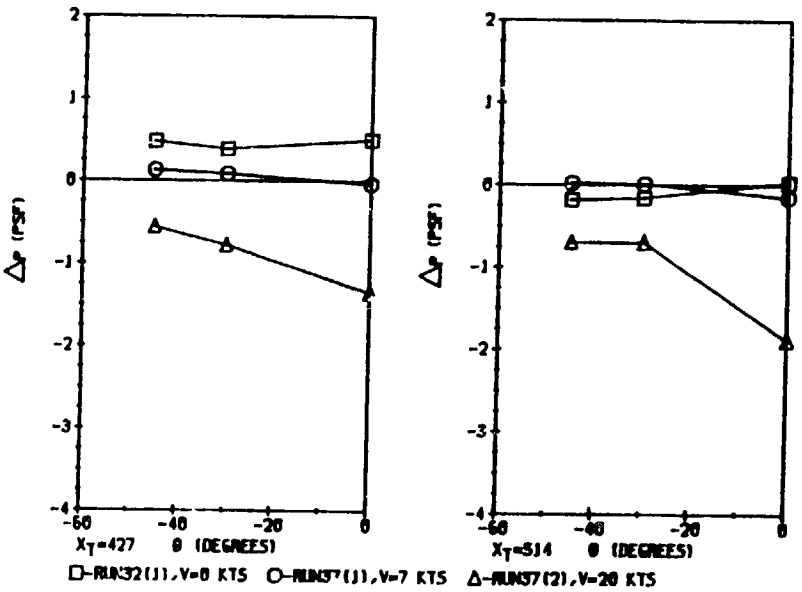


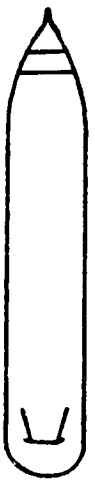












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

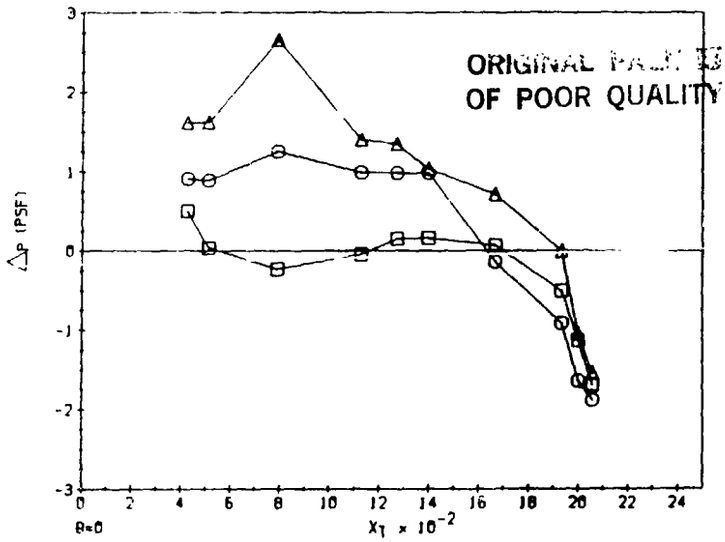
GROUP XIX

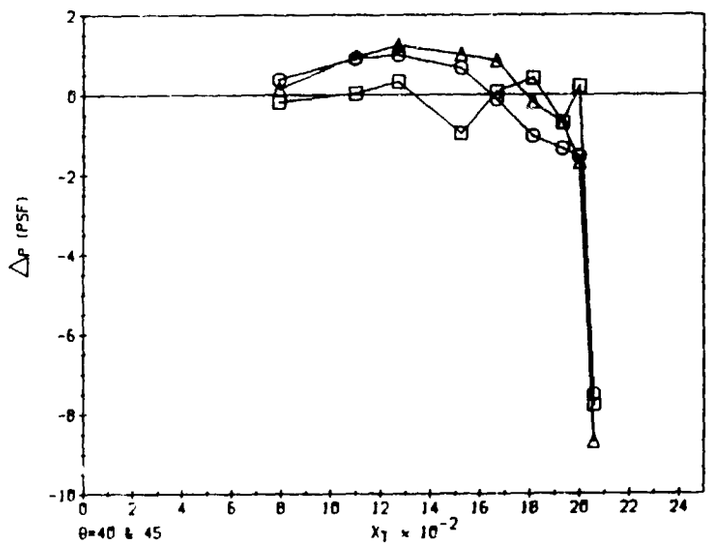
WIND VELOCITY EFFECTS AT 180°, HIGH FLOWRATE

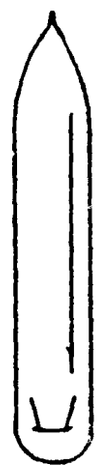
RUNS 38.1 and 38.2

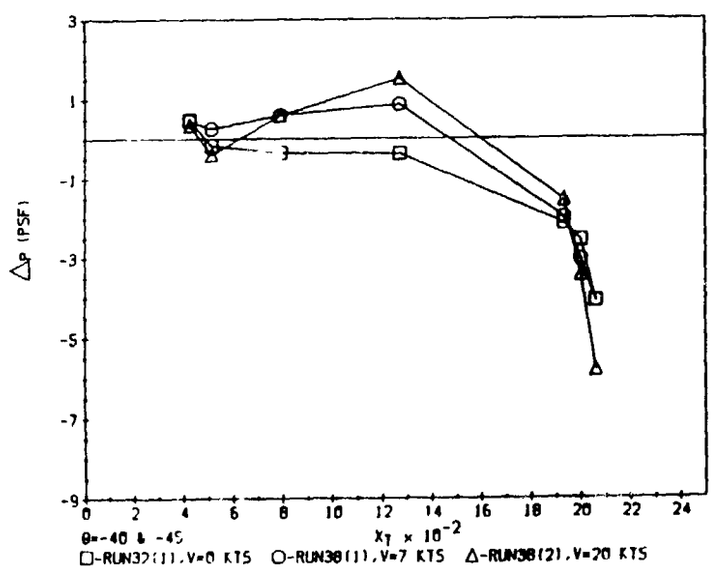
$\beta = 180°$

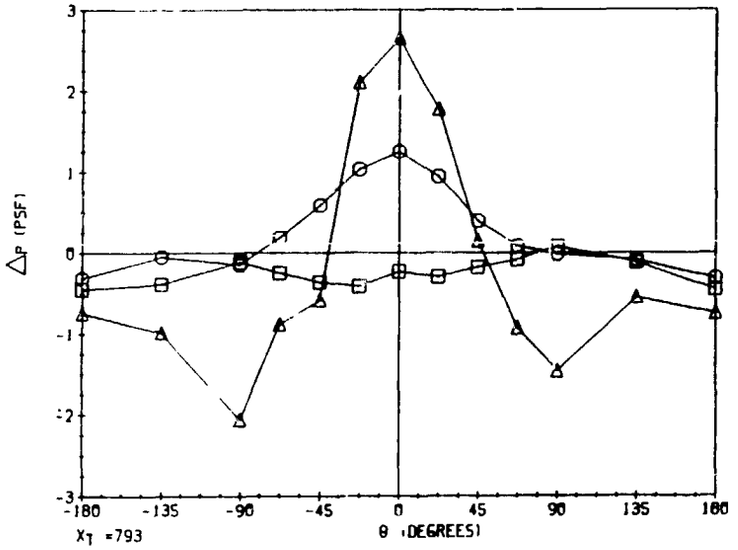
High Flowrate

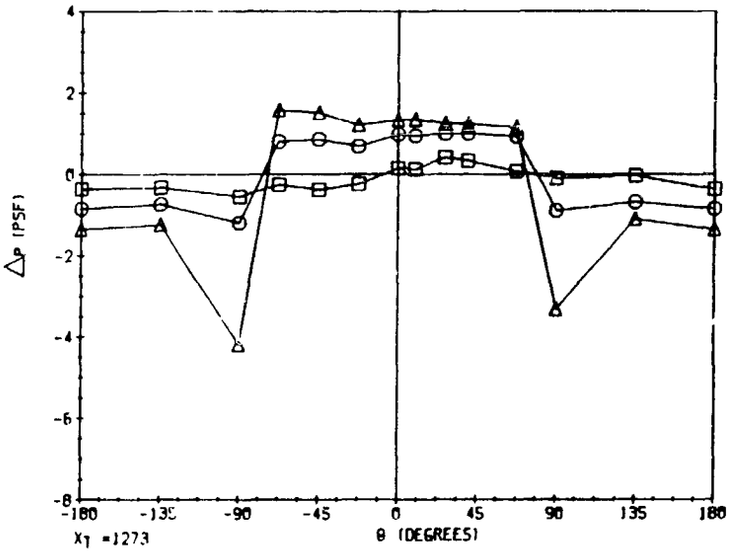


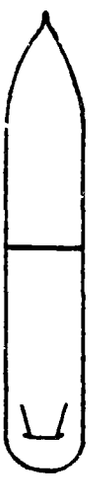


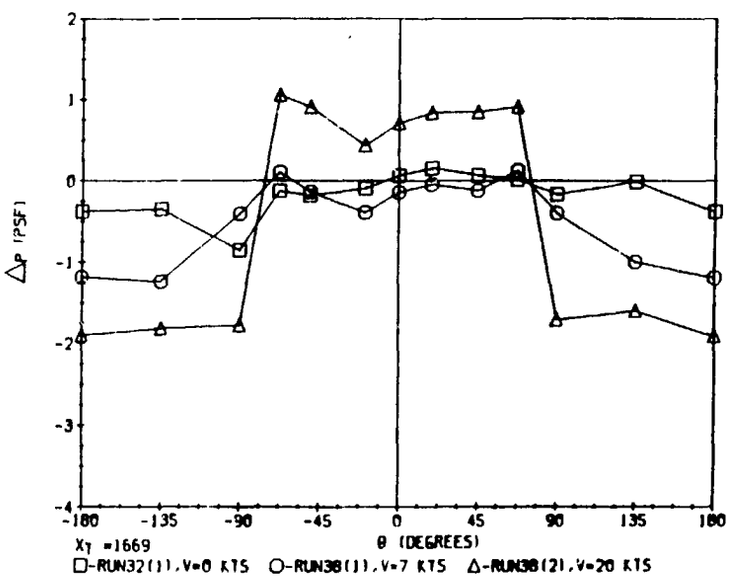


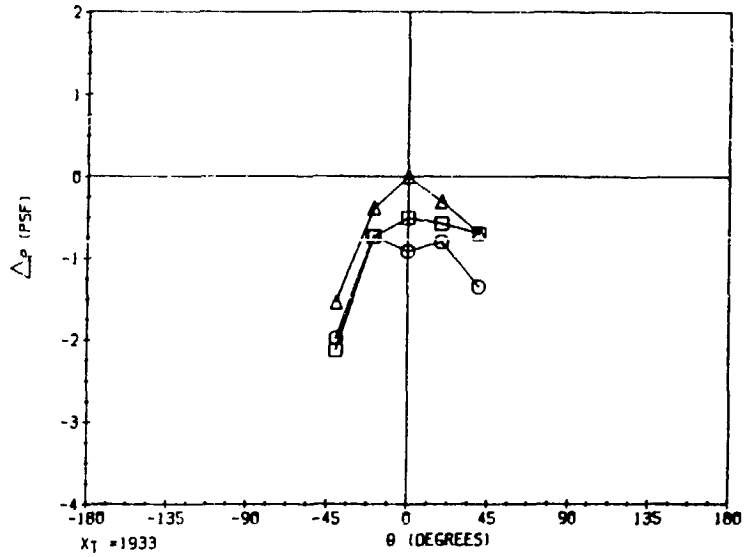


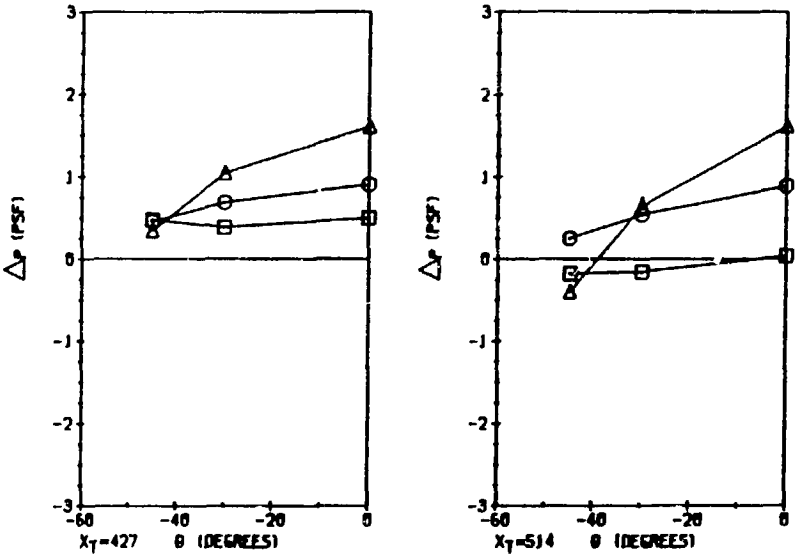












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

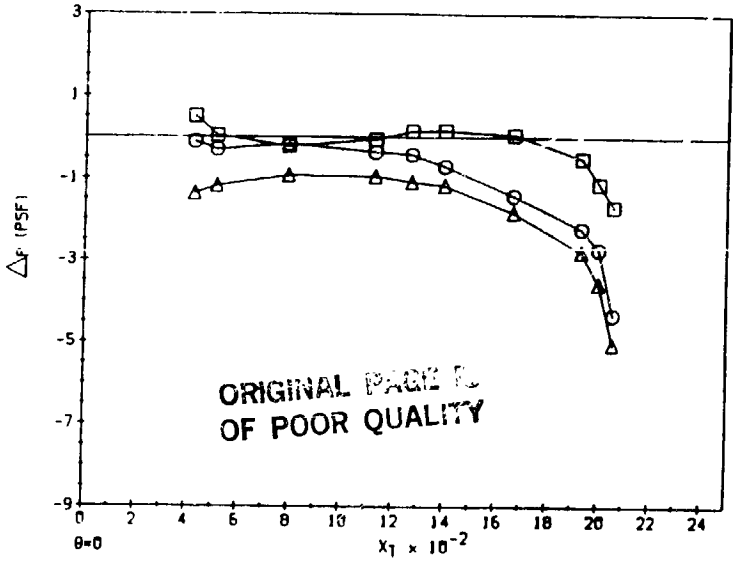
GROUP XX

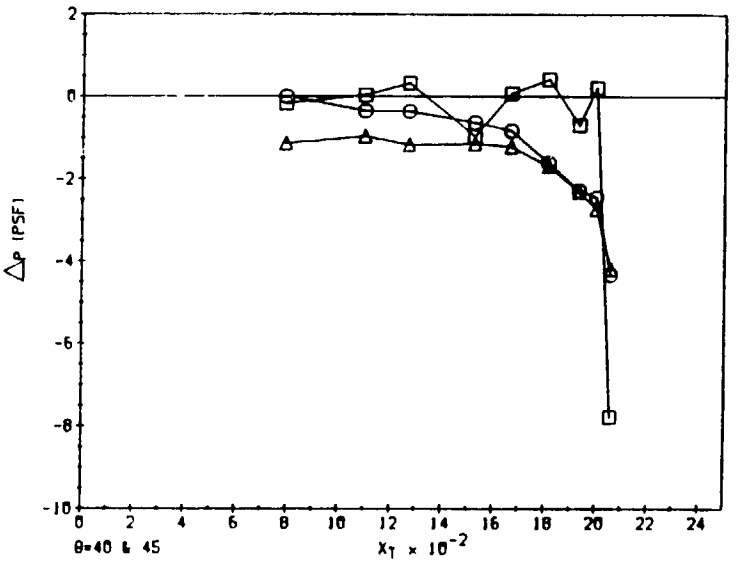
WIND VELOCITY EFFECTS AT 338°, HIGH FLOWRATE

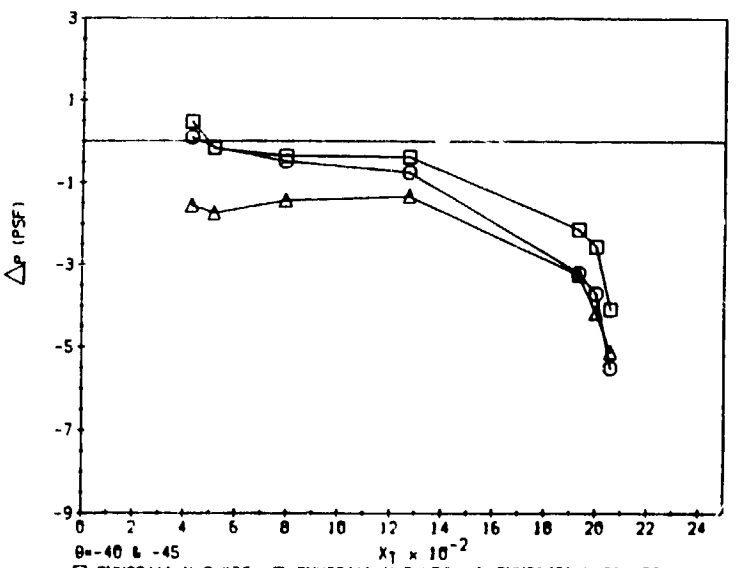
RUNS 39.1 and 39.2

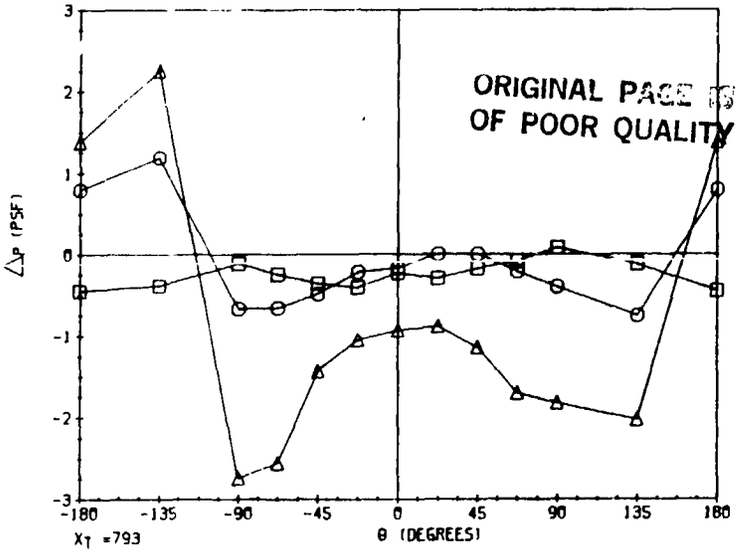
$\beta = 338°$

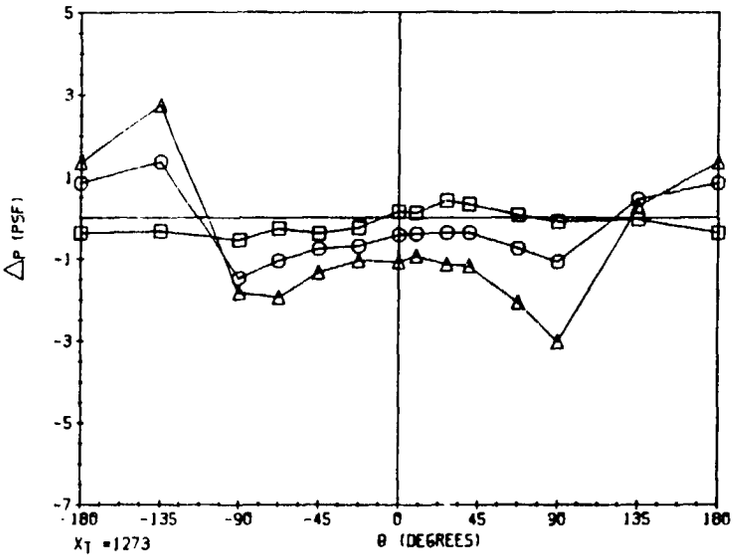
High Flowrate

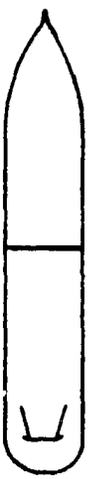


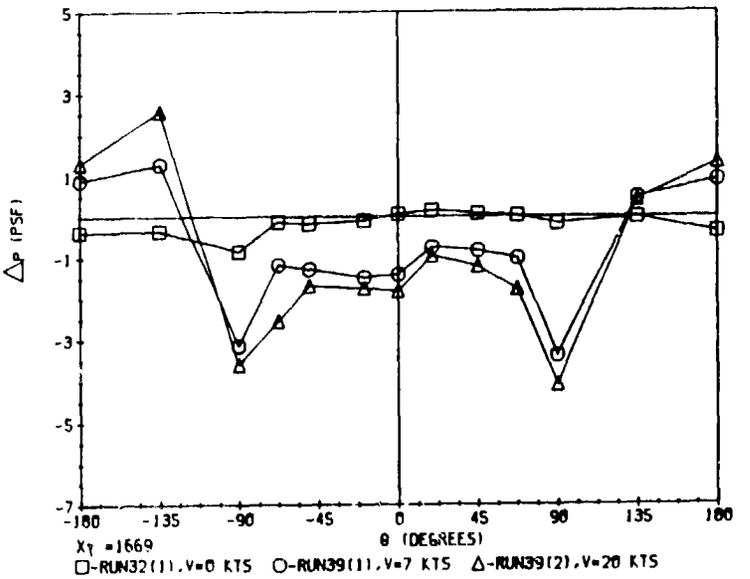


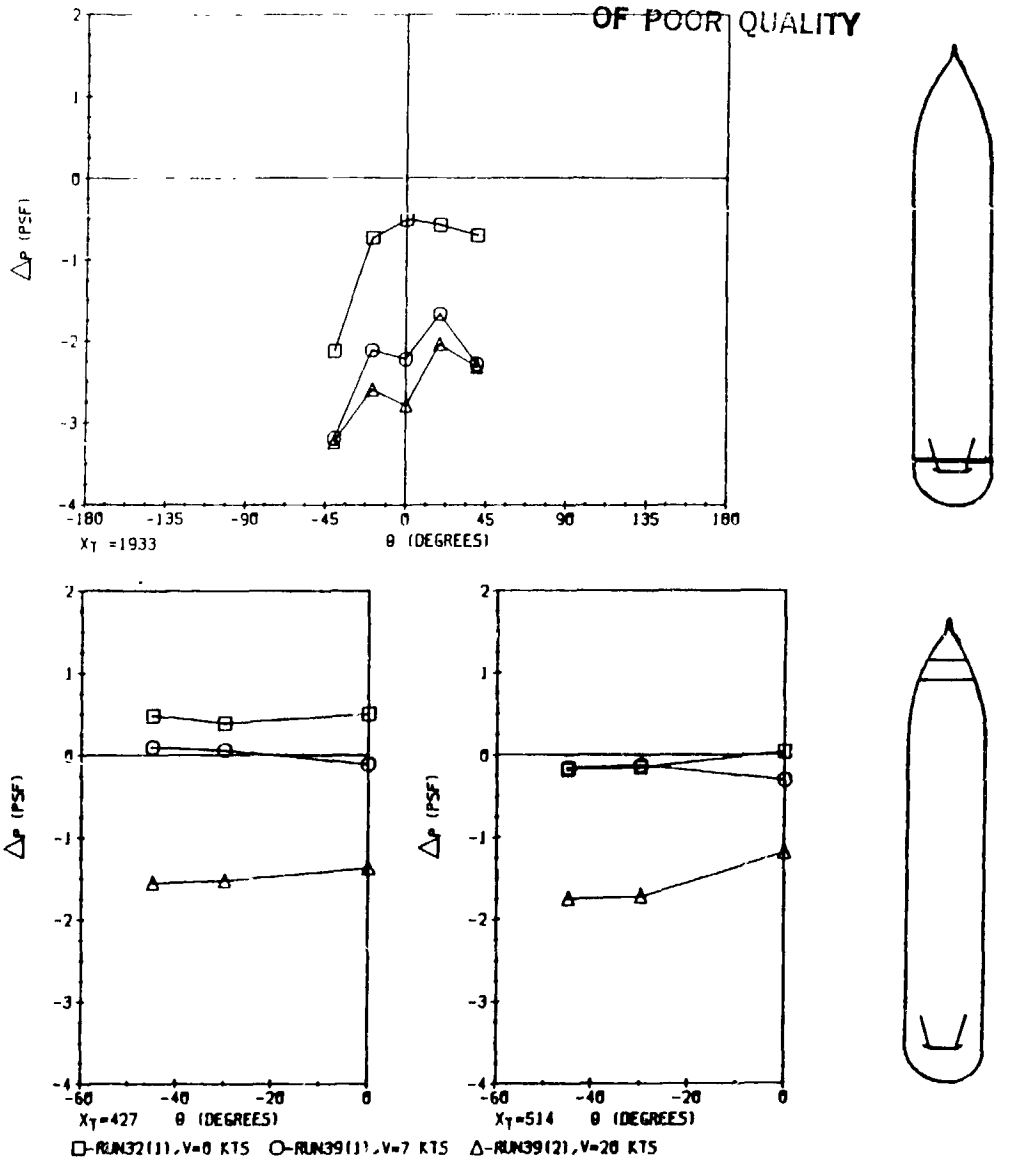












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

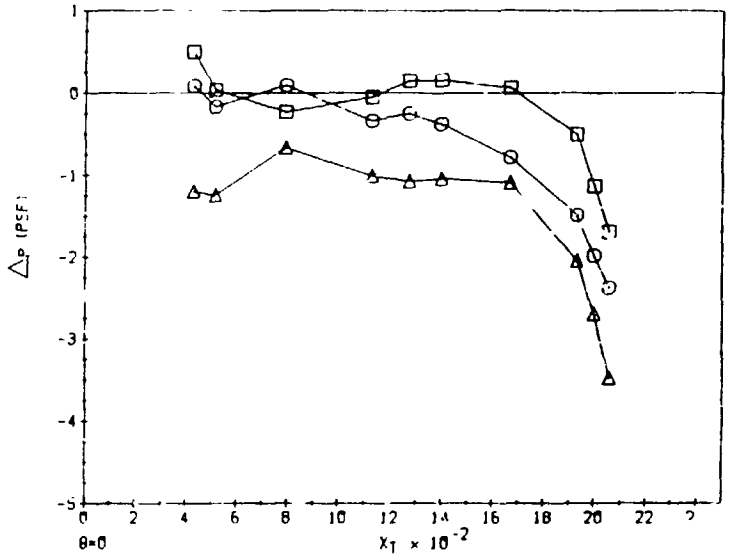
GROUP XXI

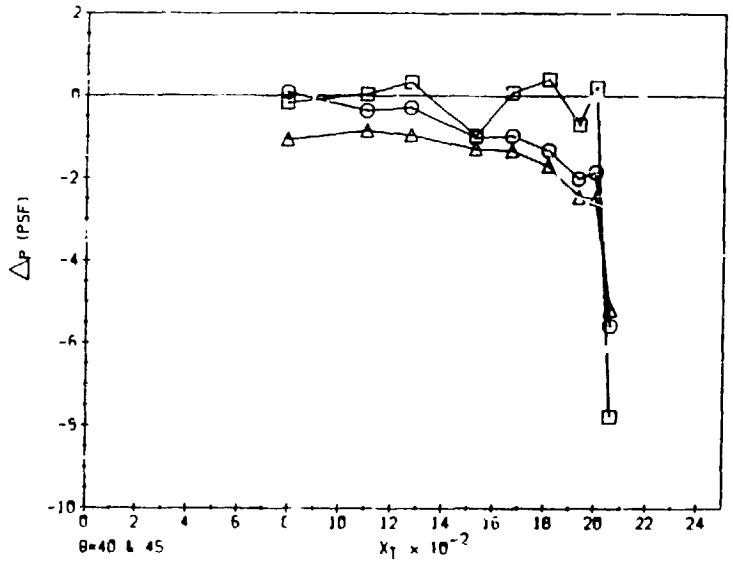
WIND VELOCITY EFFECTS AT 0°, HIGH FLOWRATE

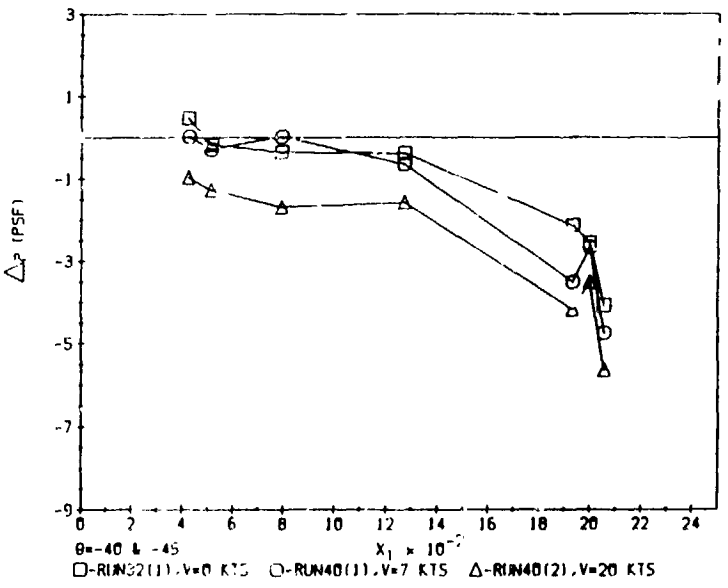
RUNS 40.1 and 40.2

$\beta = 0°$

High Flowrate







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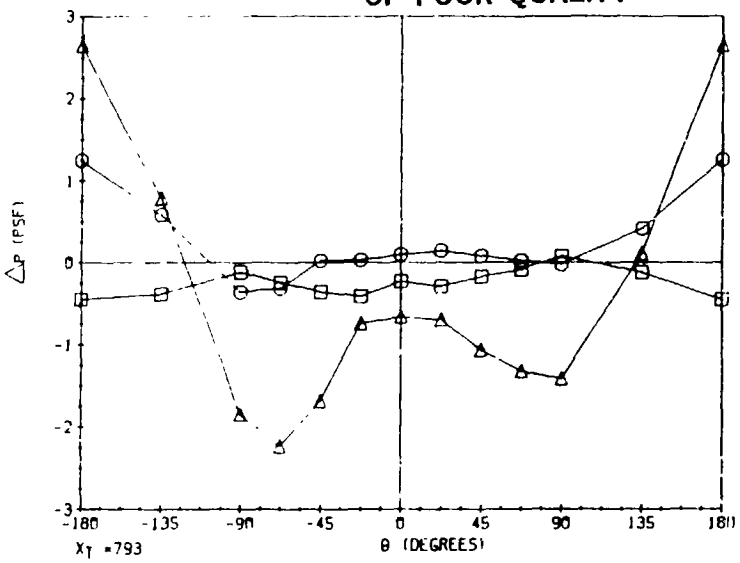
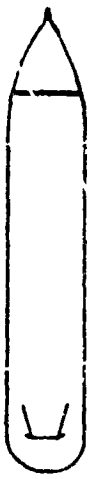
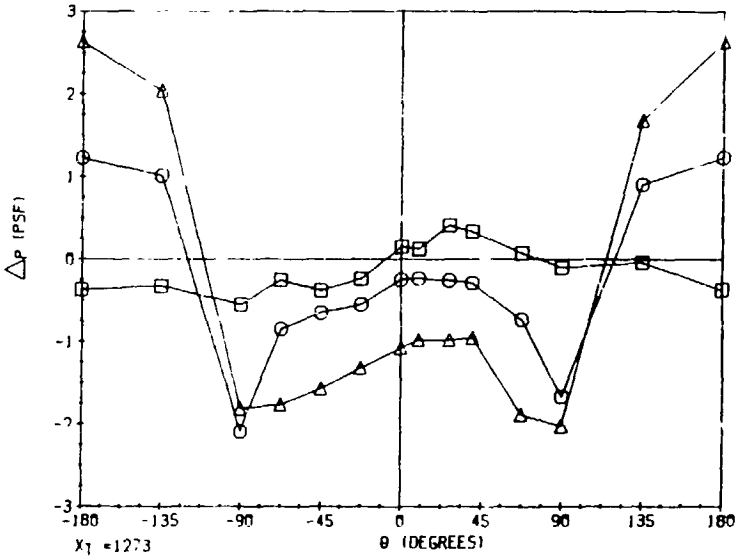
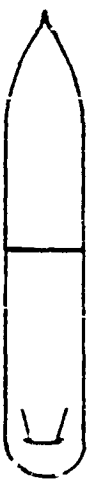
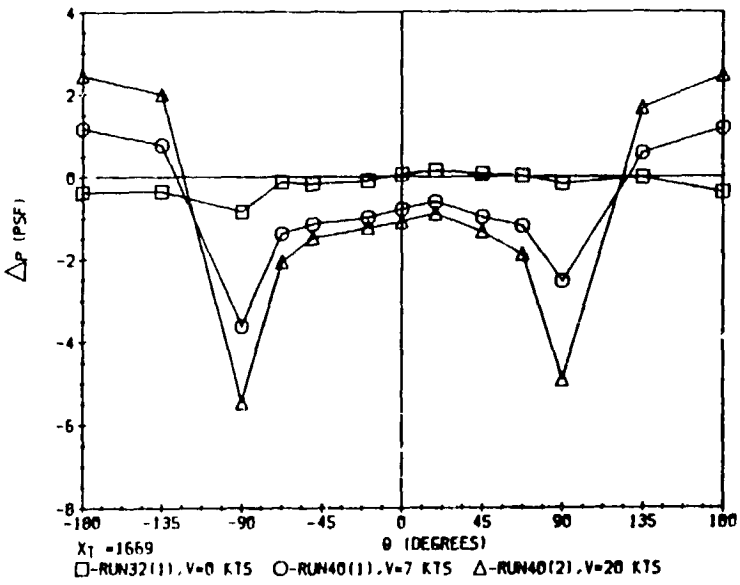
OF POOR QUALITY

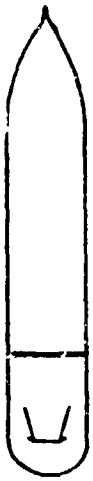


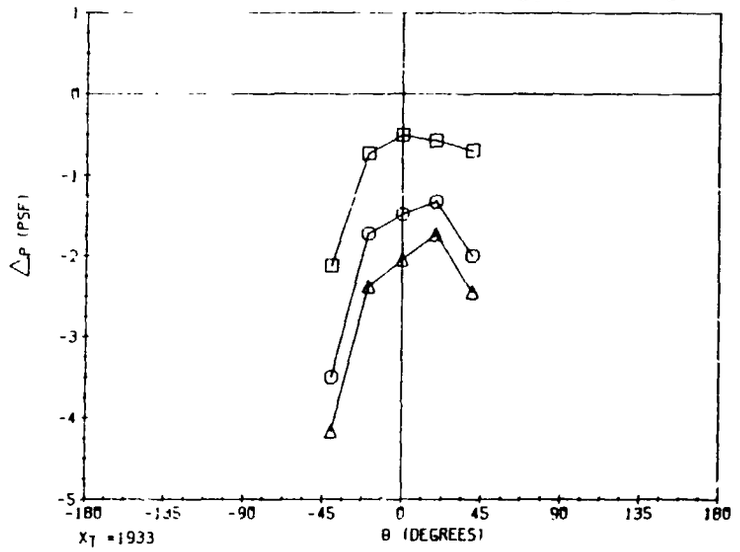


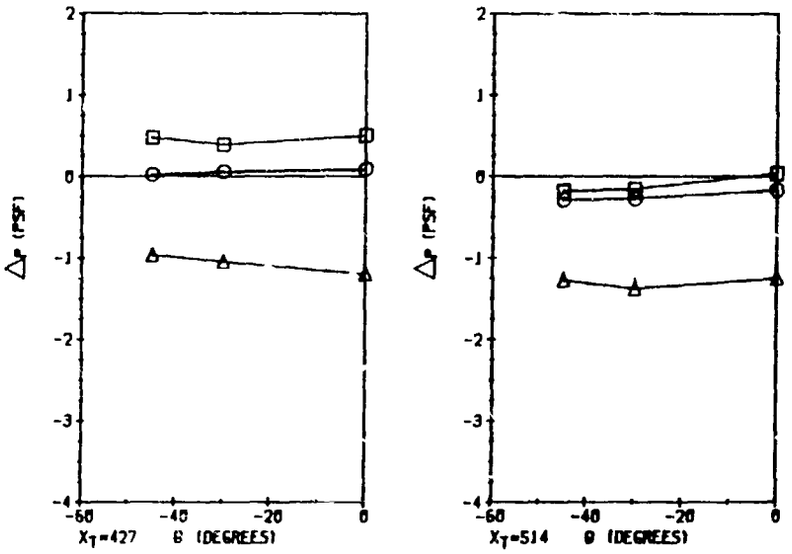












□-RUN32(1), V=0 KTS ○-RUN40(1), V=7 KTS △-RUN40(2), V=20 KTS

MARSHALL SPACE FLIGHT CENTER CONFIGURATION

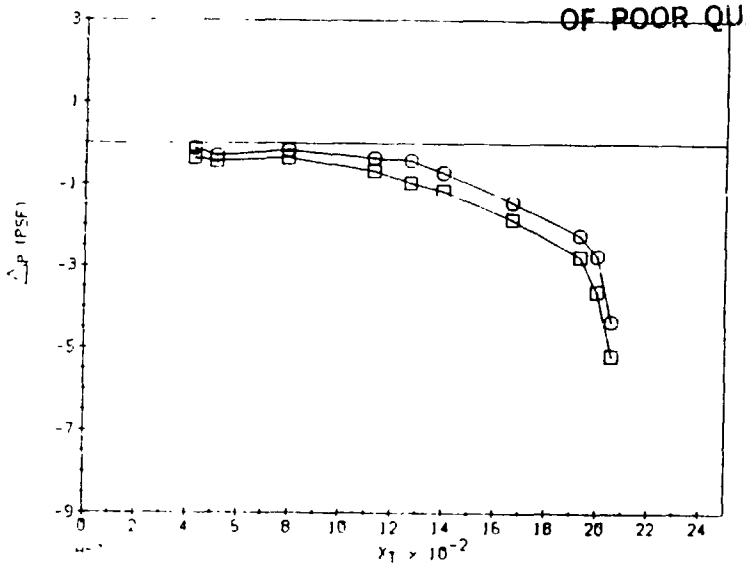
GROUP XXII

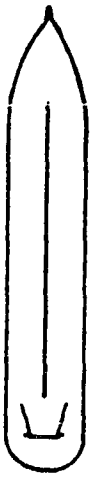
FLOWRATE EFFECTS AT 7 KT

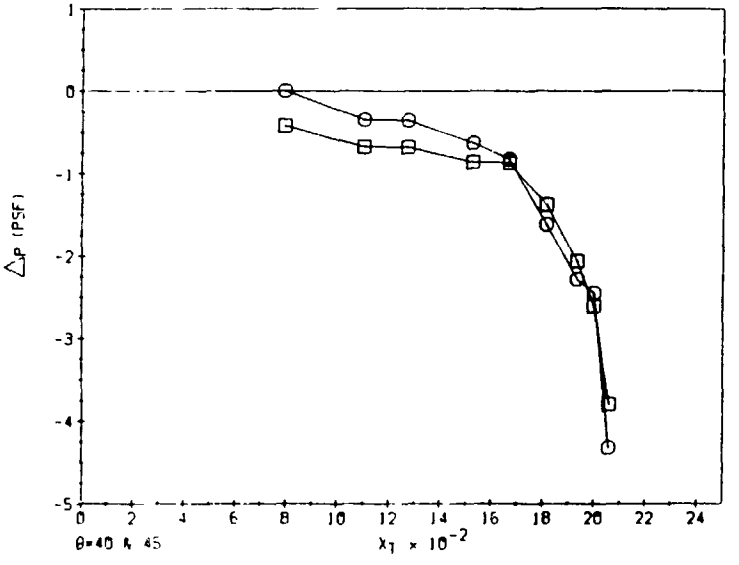
RUNS 34.1 and 39.1

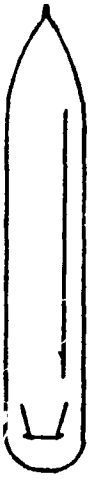
V = 7 KNOTS

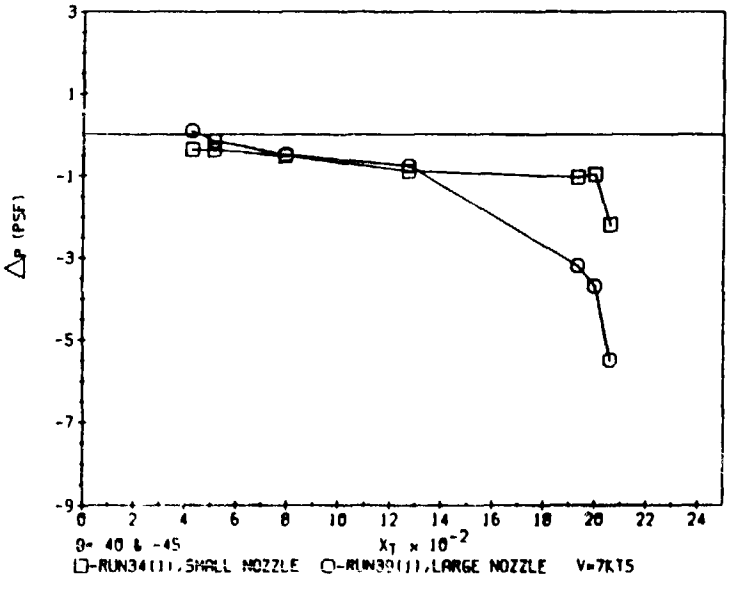
β = 338°

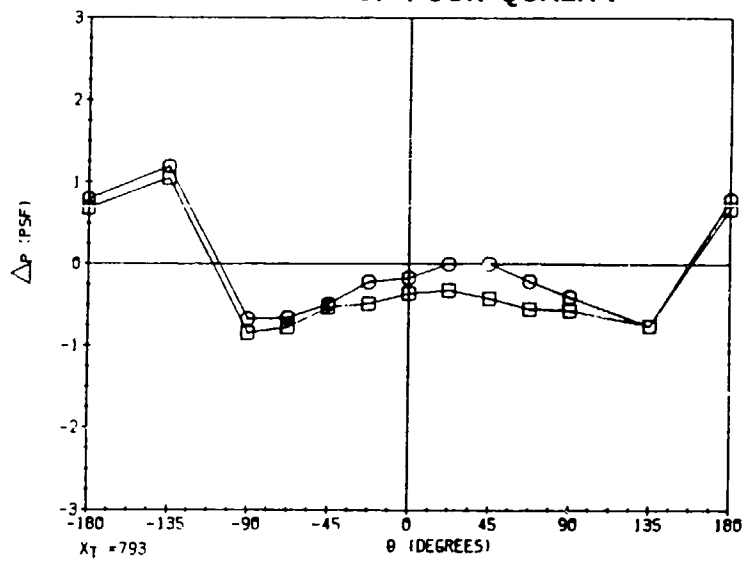


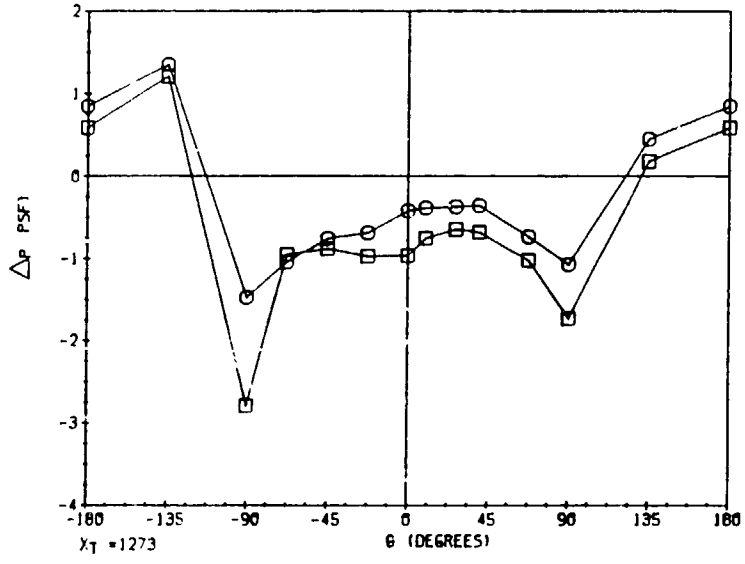


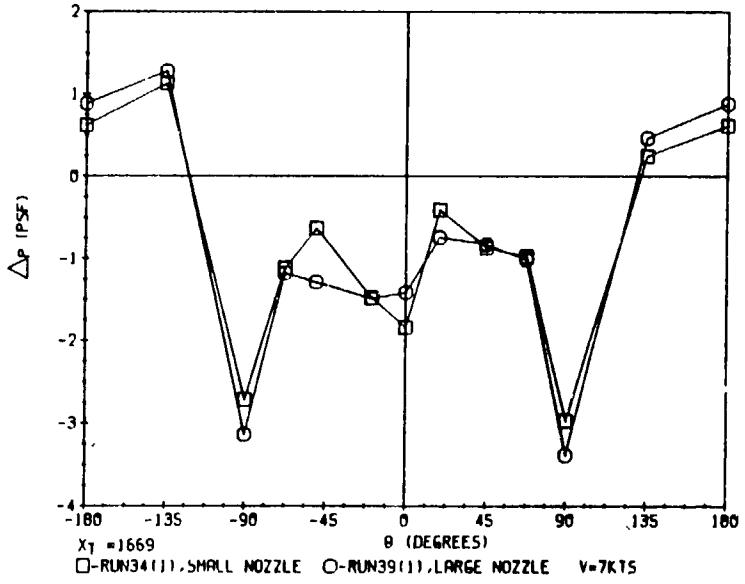


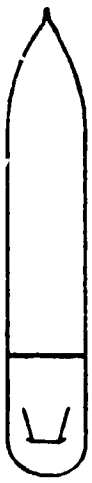


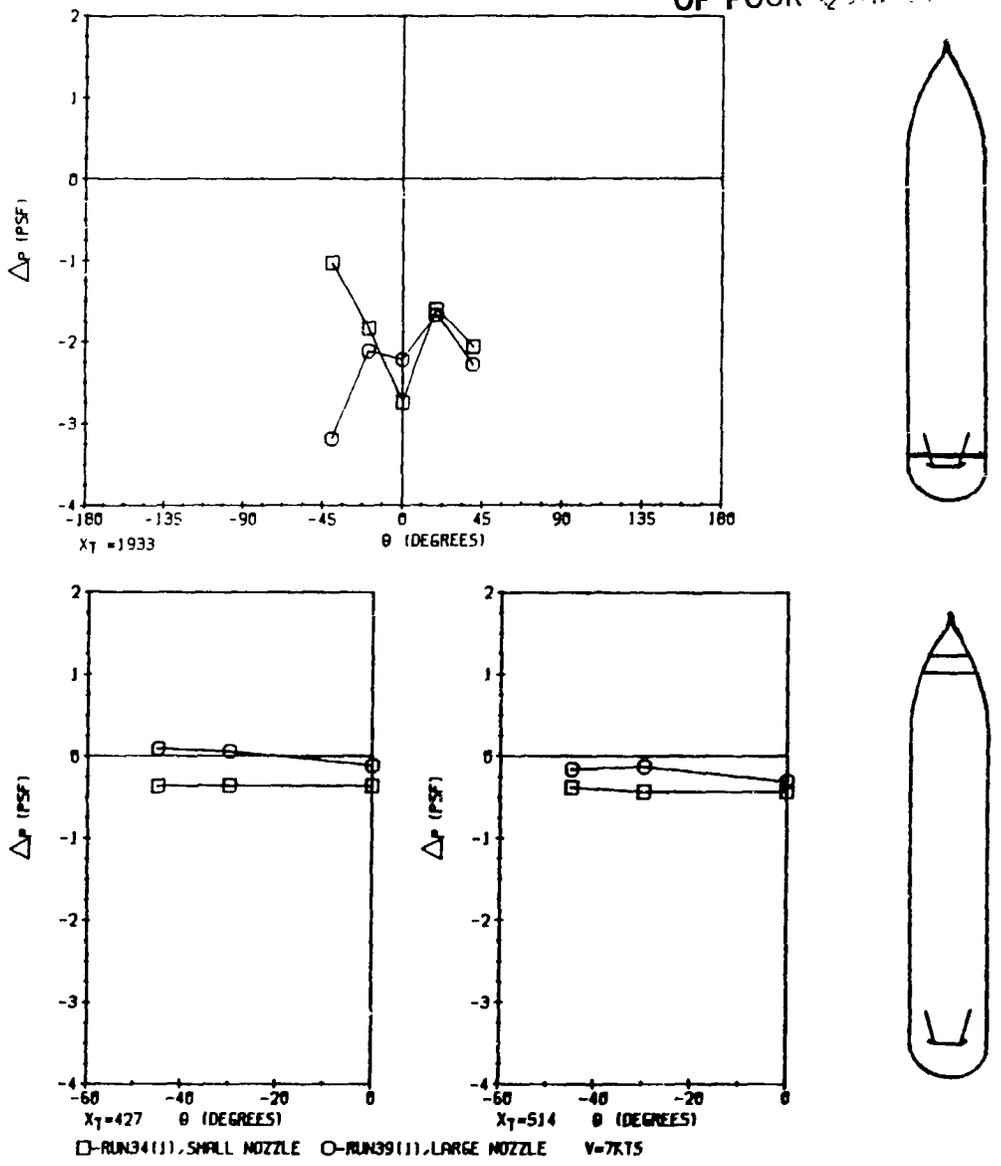












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

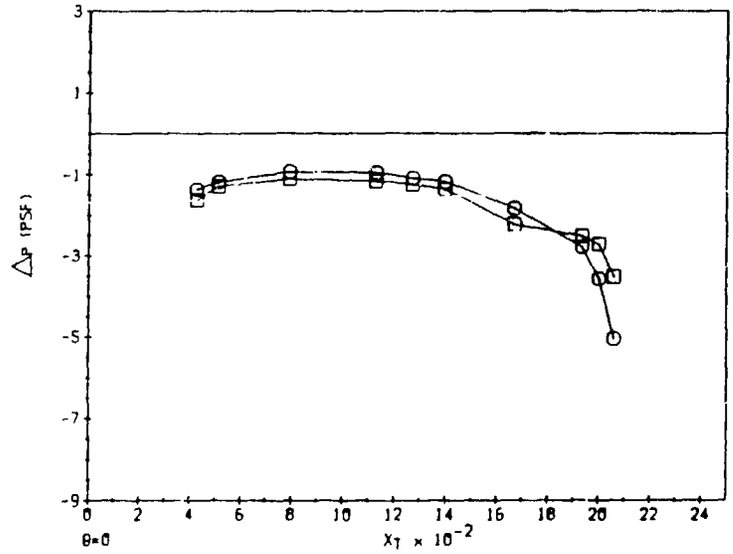
GROUP XXIII

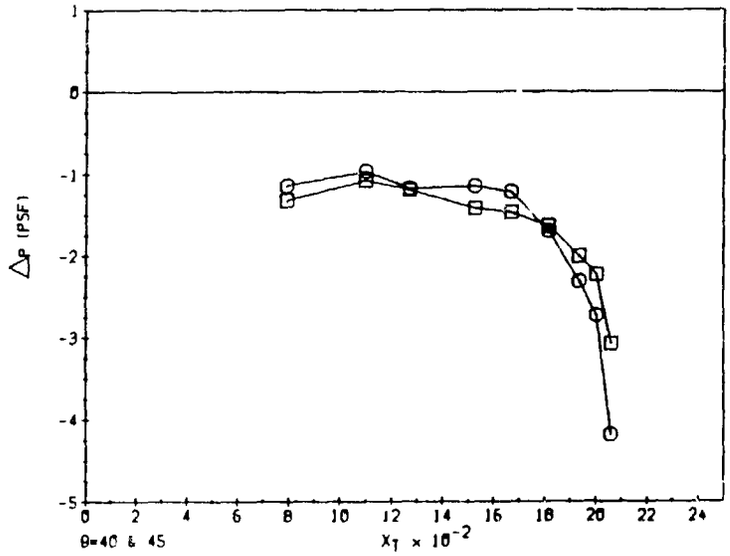
FLOWRATE EFFECTS AT 20 KT

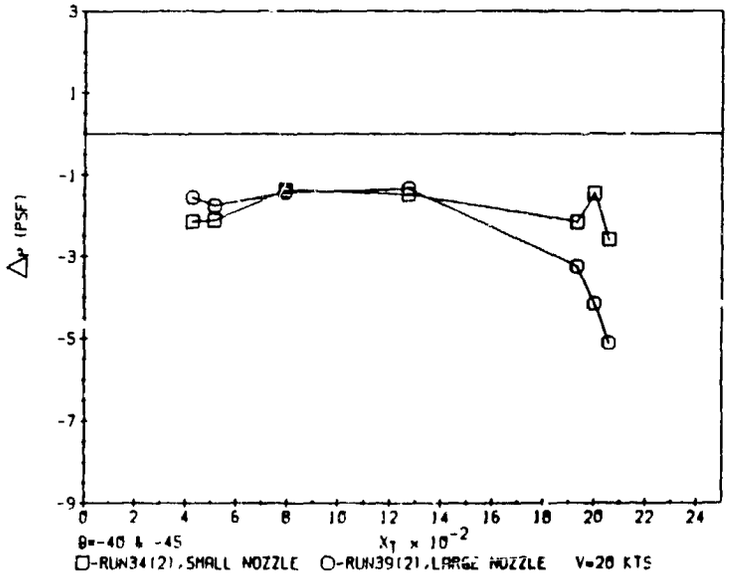
RUNS 34.2 and 39.2

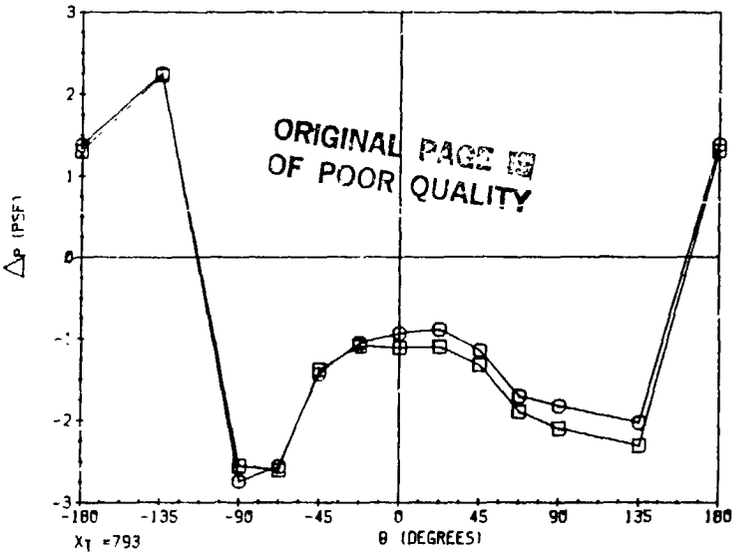
V = 20 KNOTS

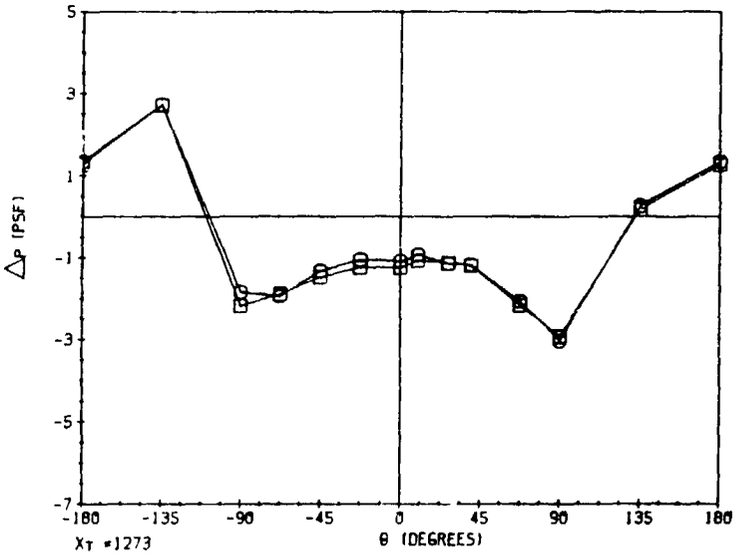
β = 338°

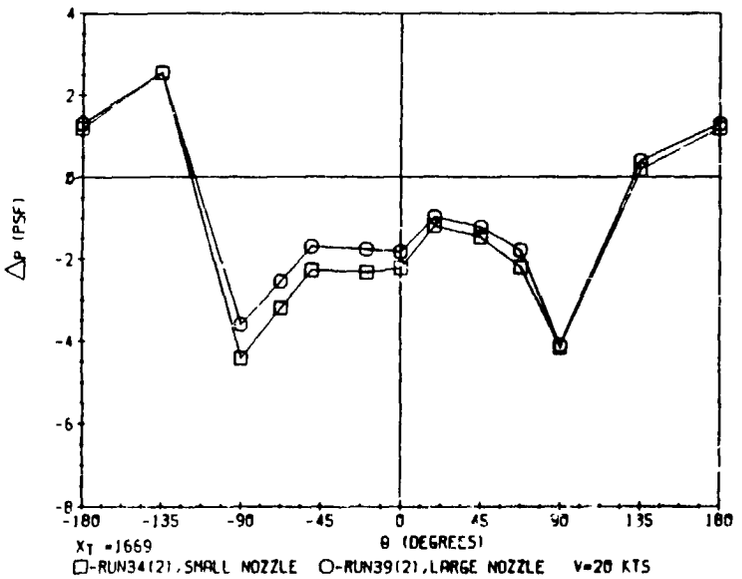


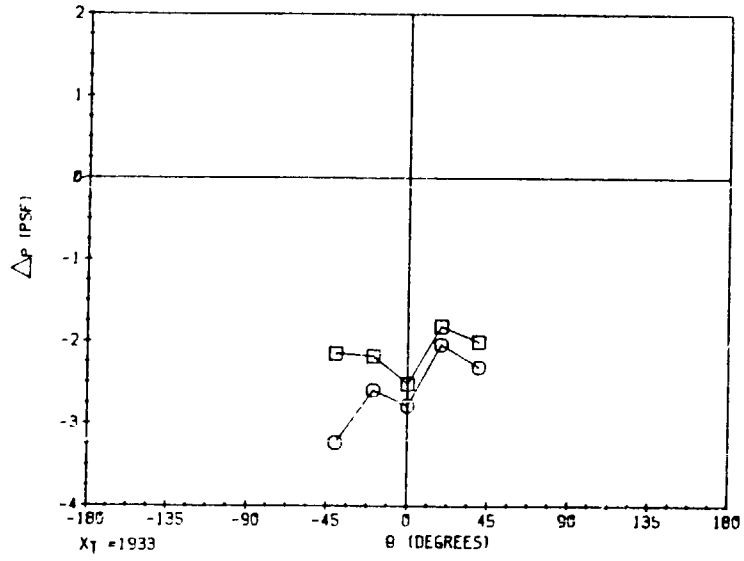


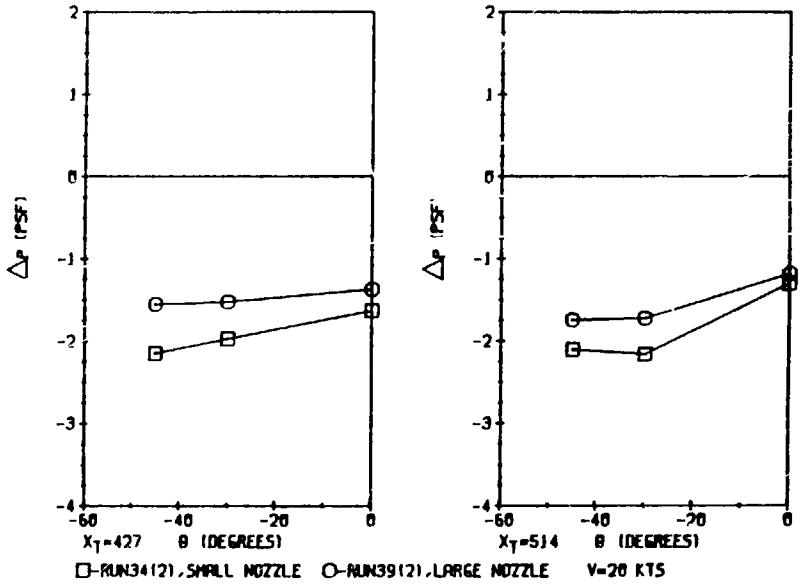












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

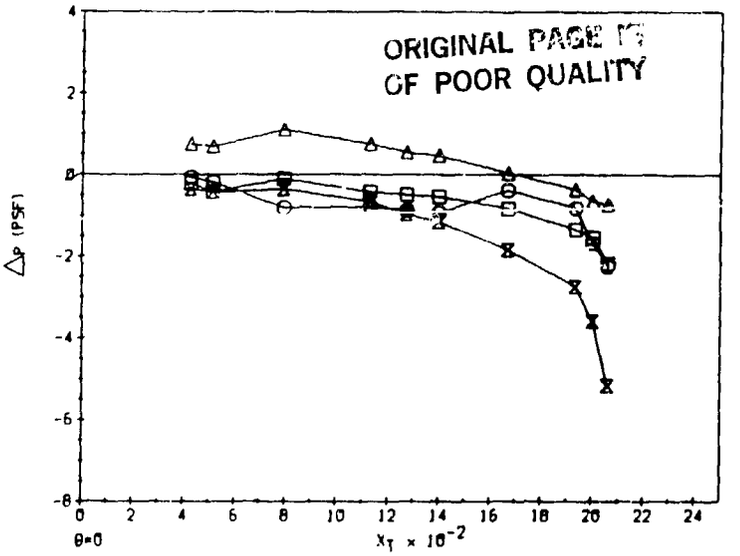
GROUP XXIV

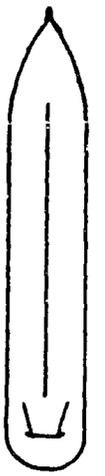
WIND DIRECTION EFFECTS AT 7 KT, LOW FLOWRATE

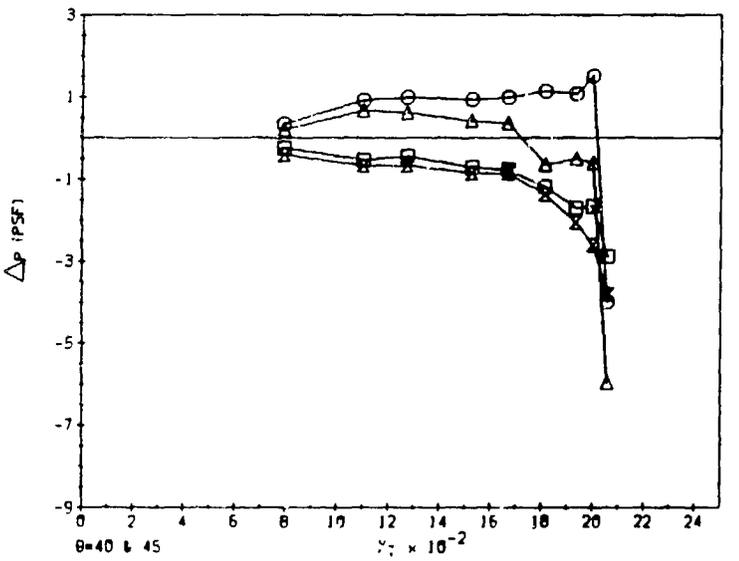
RUNS 33.1, 36.1, 35.1 and 34.1

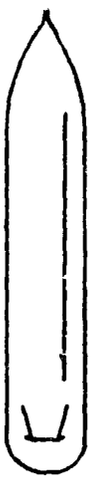
V = 7 KNOTS

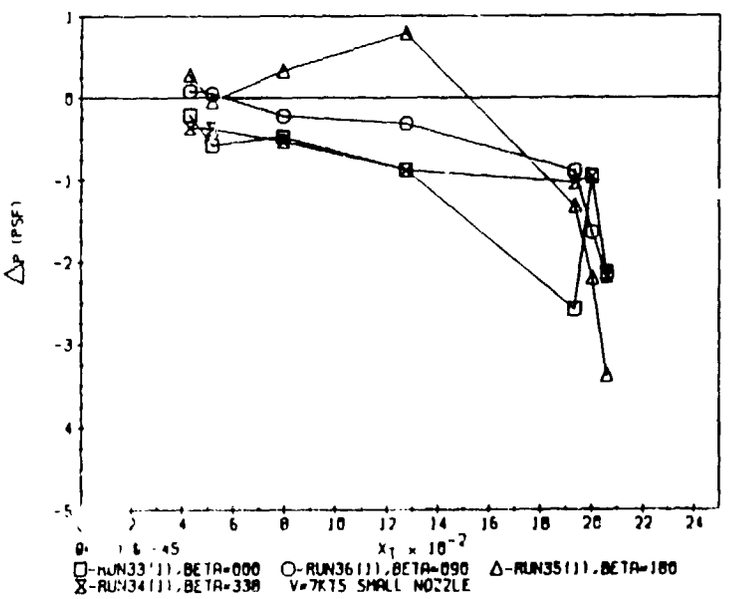
Low Flowrate

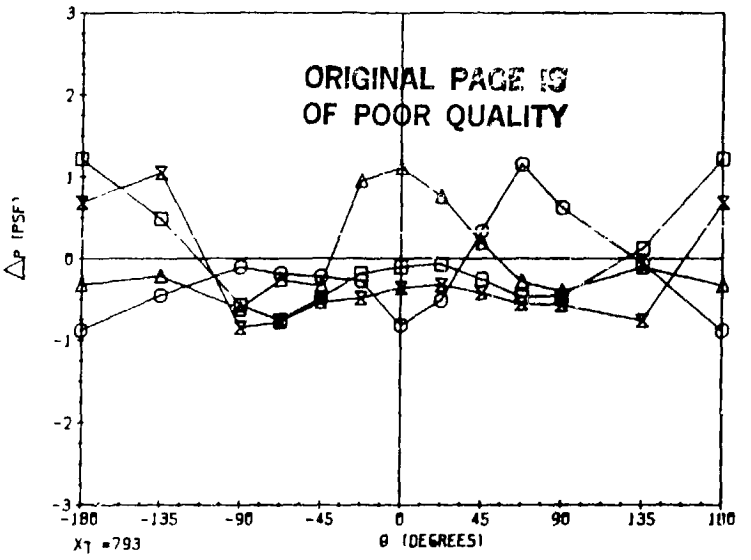


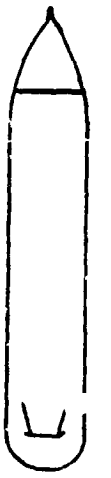


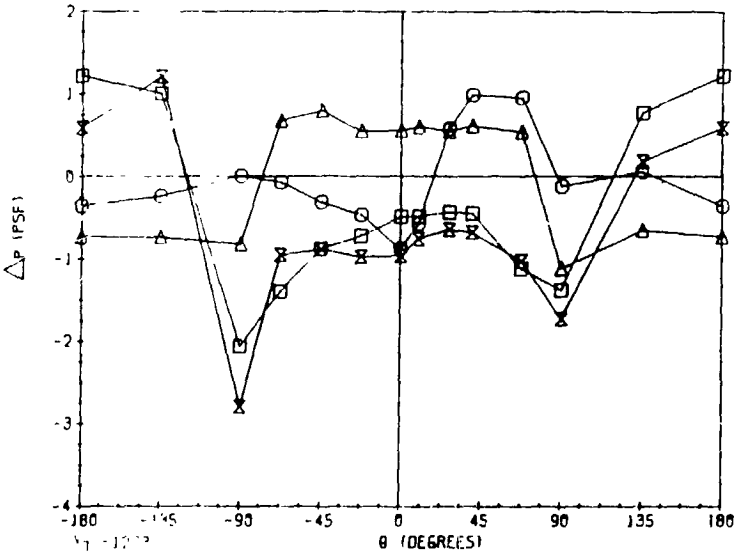


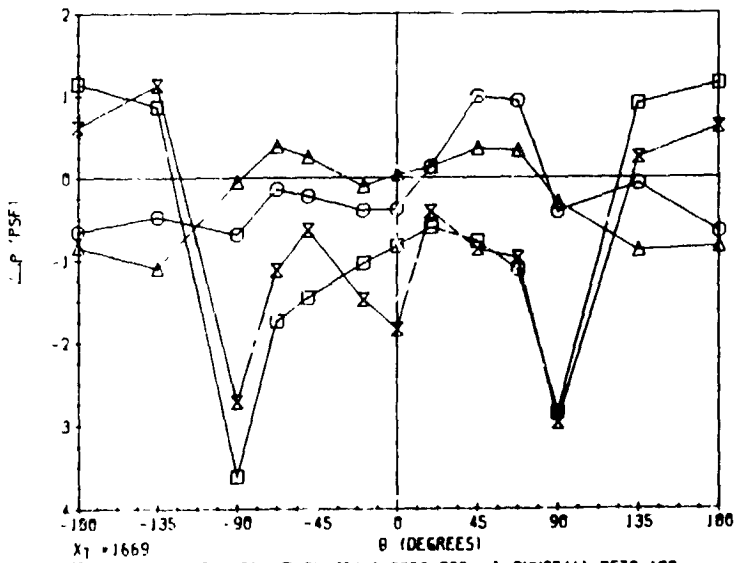


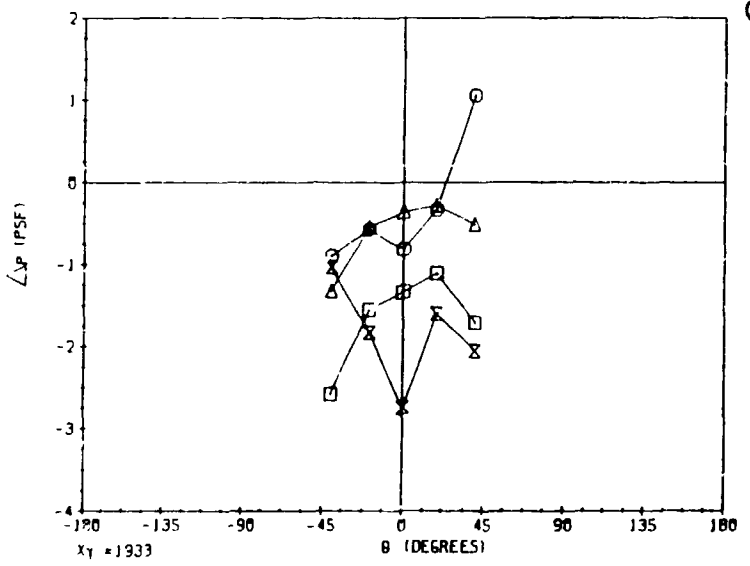


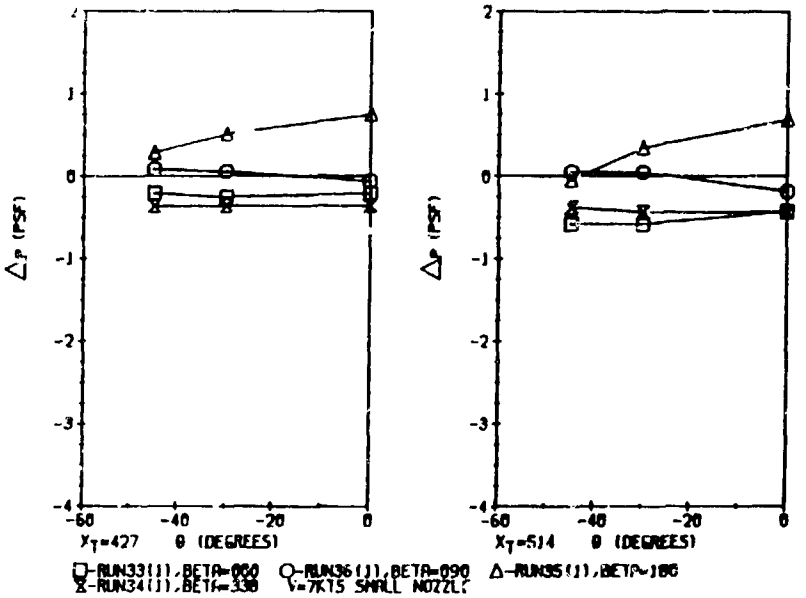












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

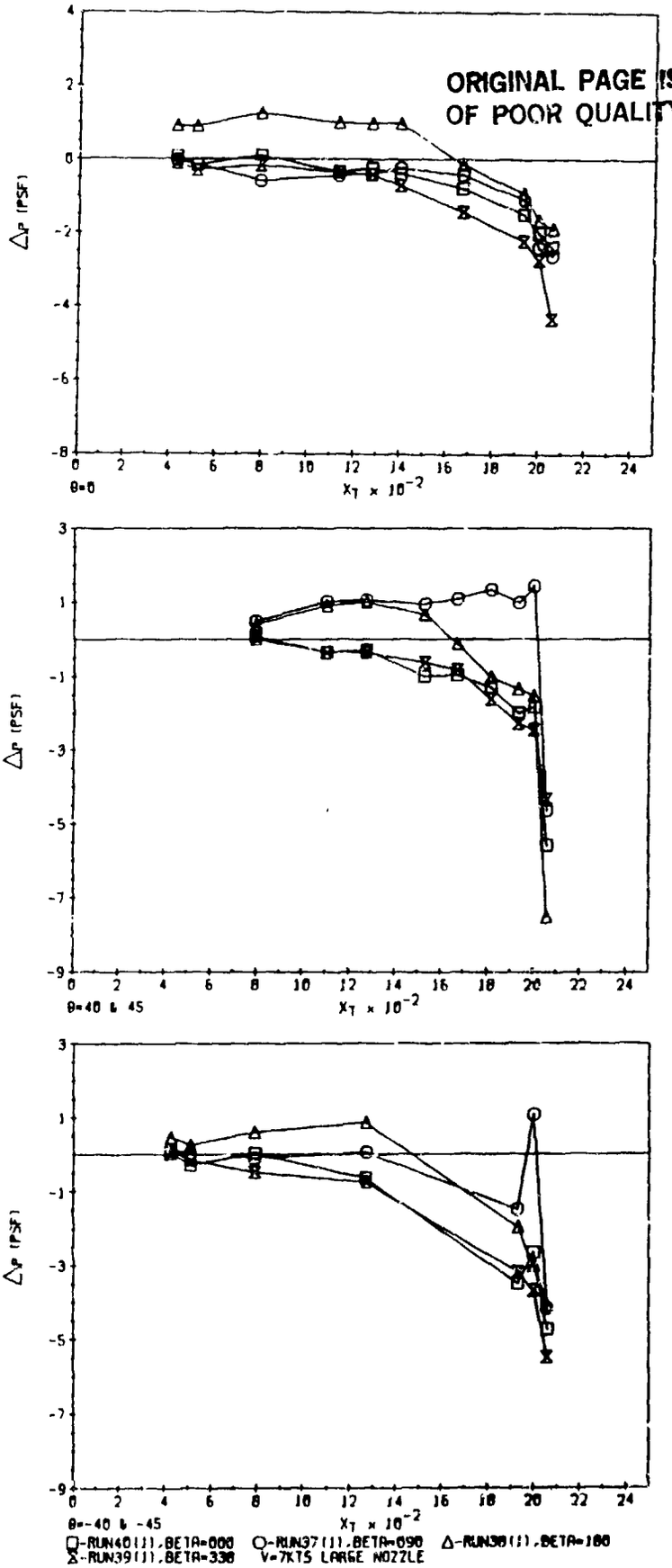
GROUP XXV

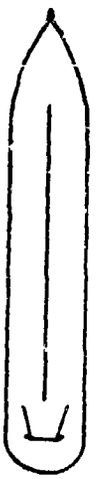
WIND DIRECTION EFFECTS AT 7 KT, HIGH FLOWRATE

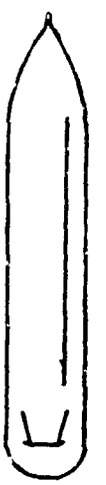
RUNS 40.1, 37.1, 38.1 and 39.1

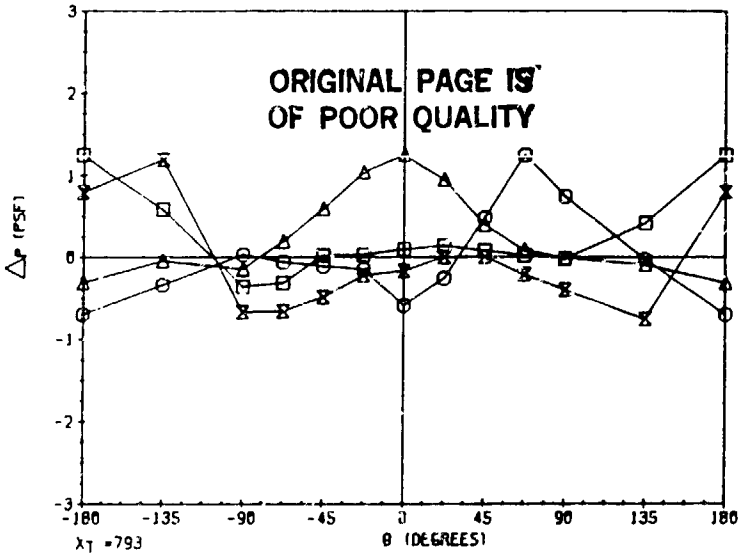
V = 7 KNOTS

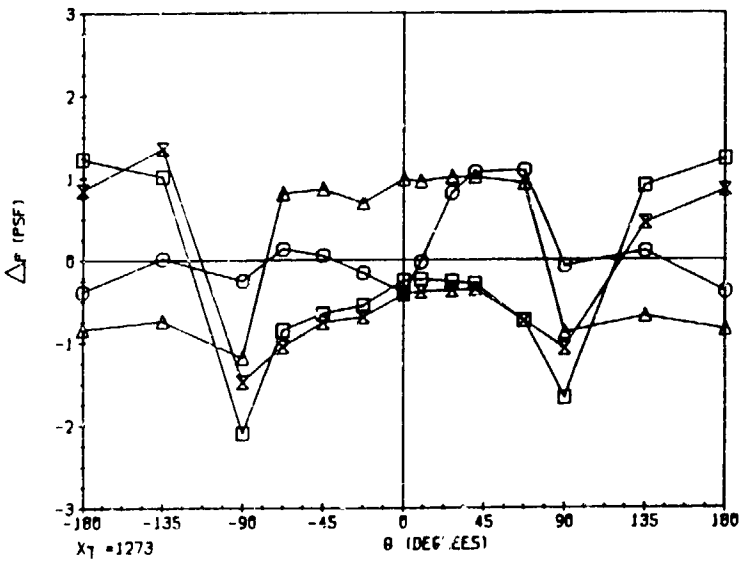
High Flowrate

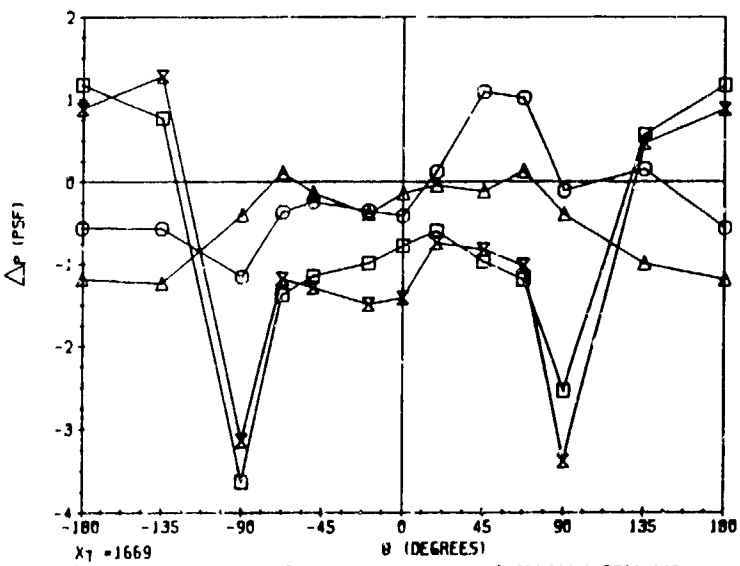


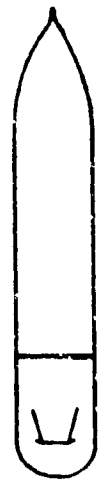


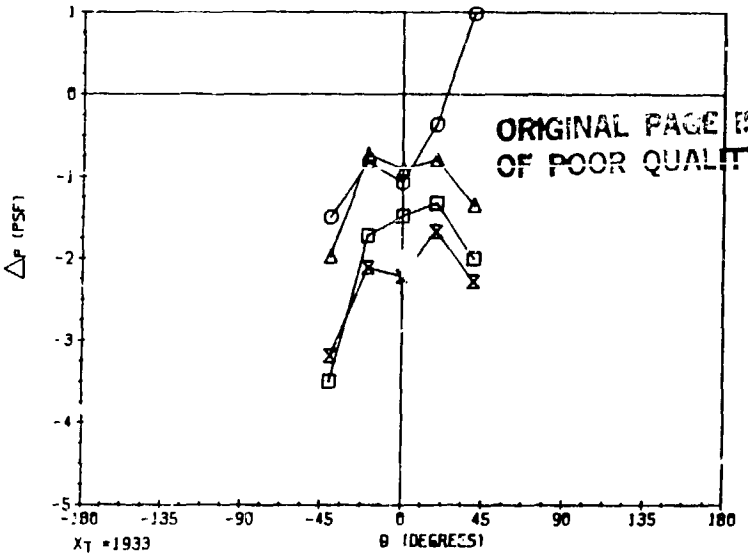


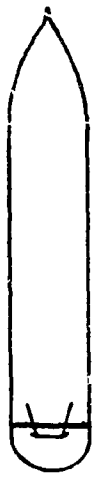


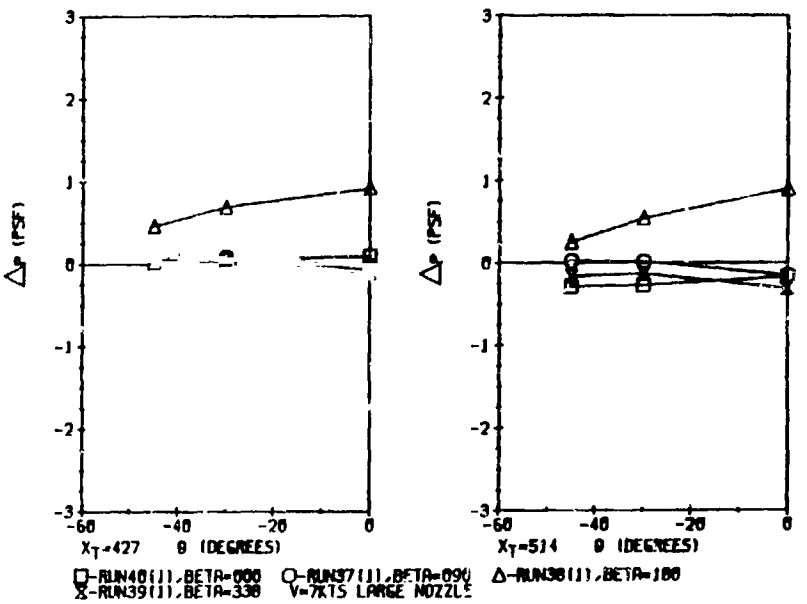


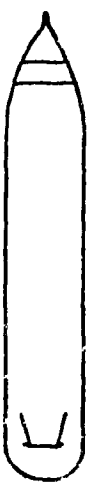












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

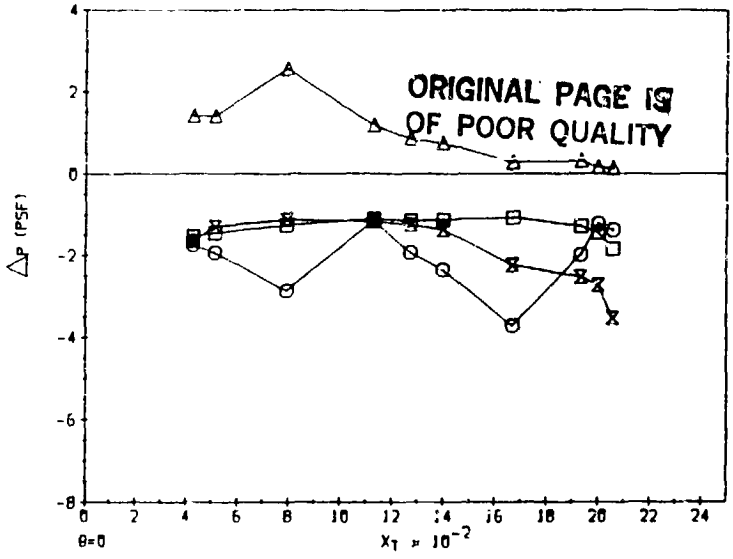
GROUP XXVI

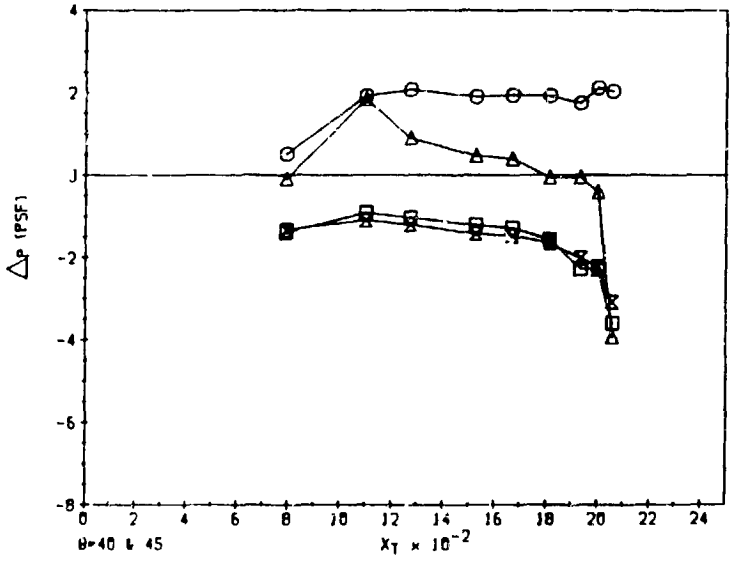
WIND DIRECTION EFFECTS AT 20 KT, LOW FLOWRATE

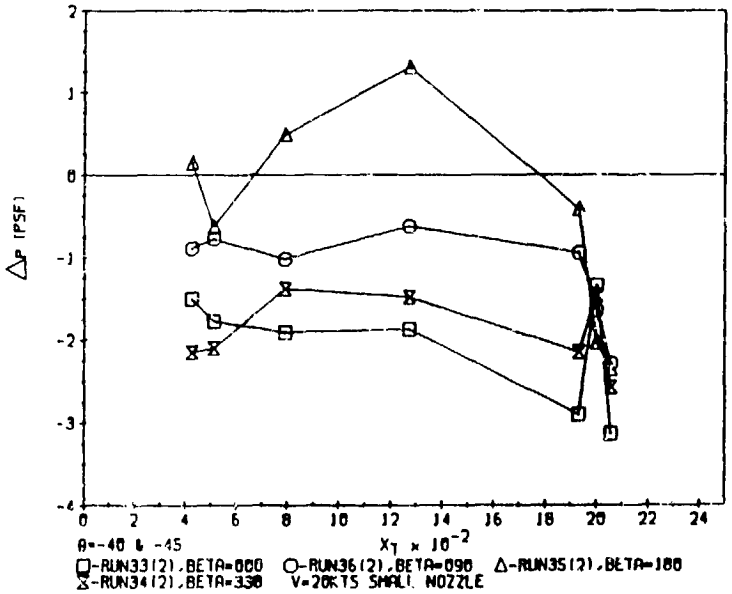
RUNS 33.2, 36.2, 35.2 and 34.2

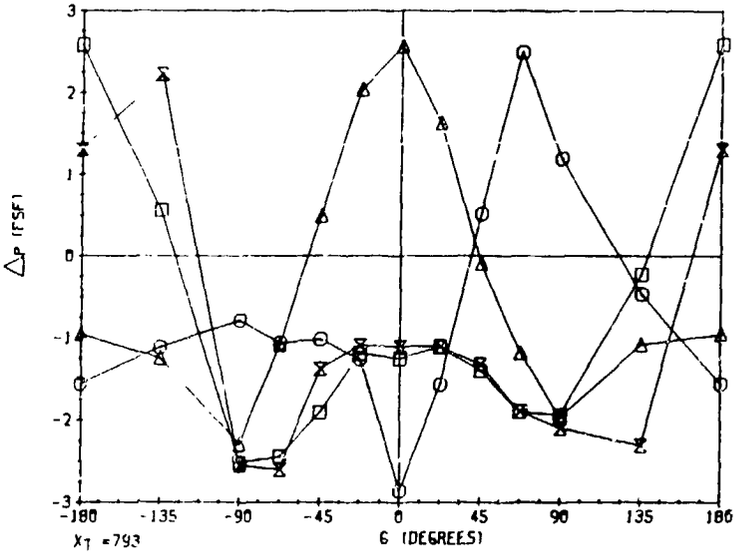
V = 20 KNOTS

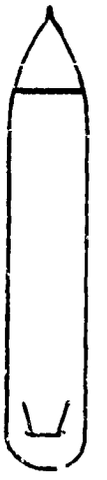
Low Flowrate

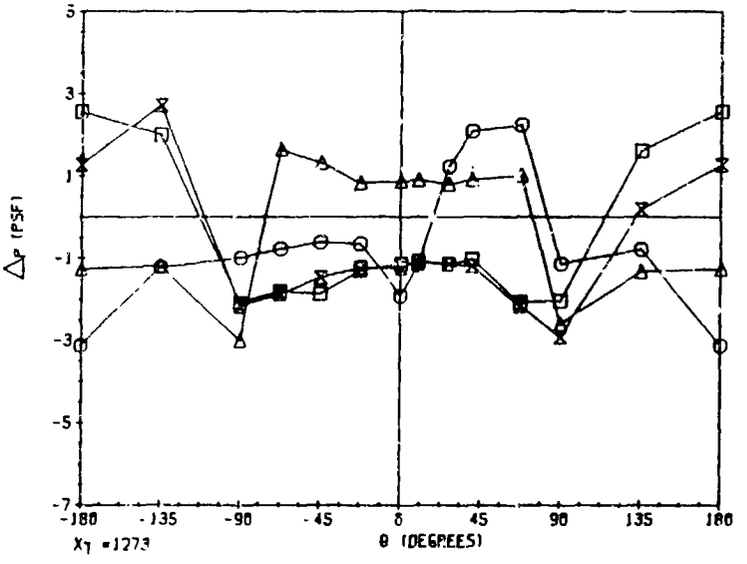


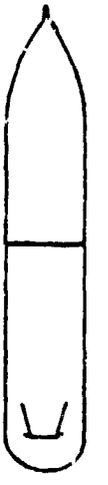


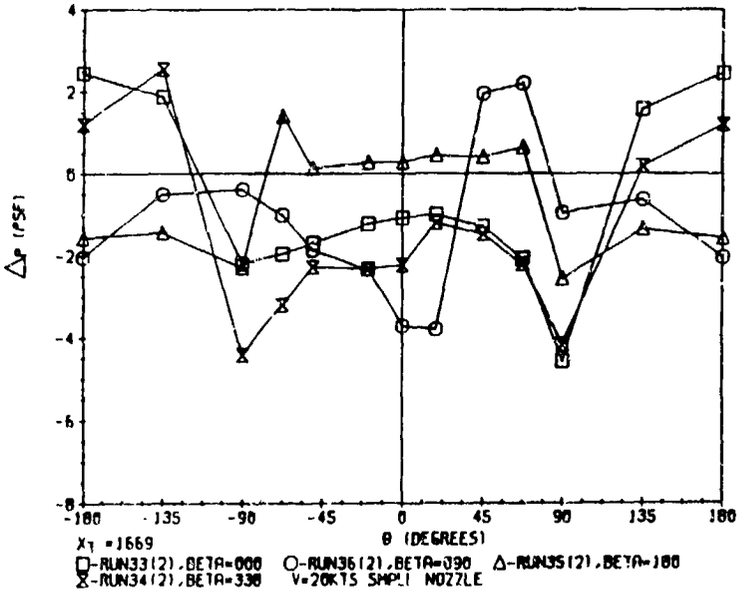


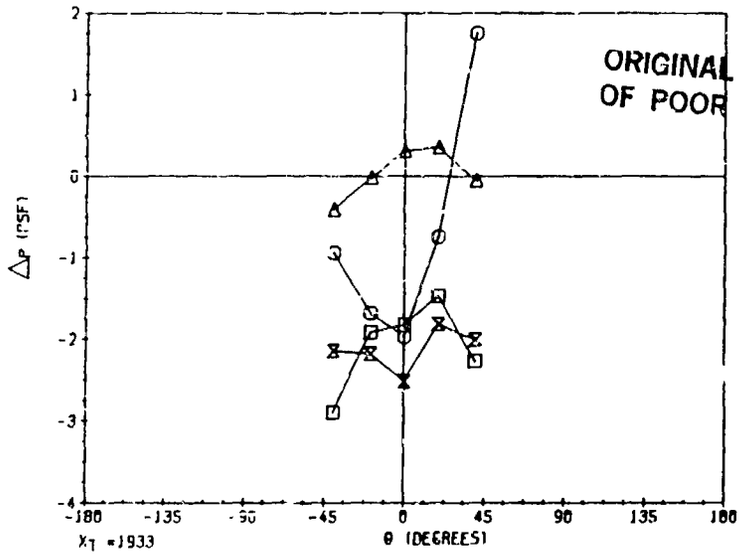


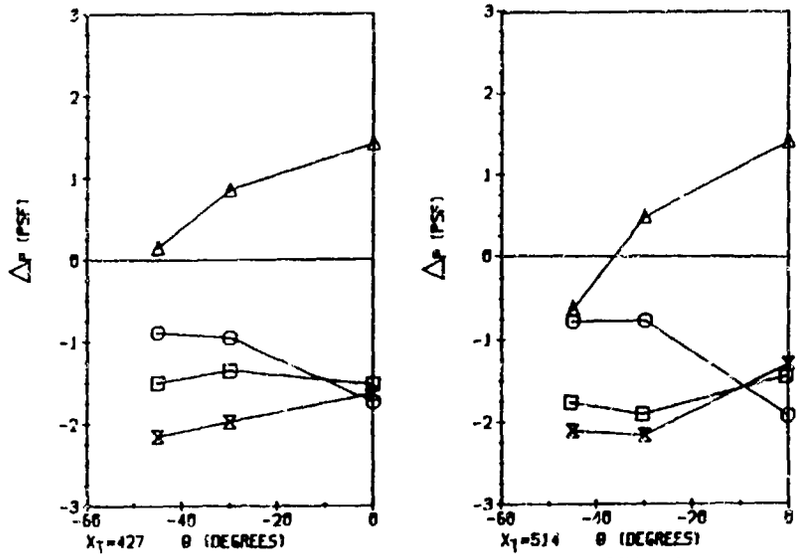












MARSHALL SPACE FLIGHT CENTER CONFIGURATION

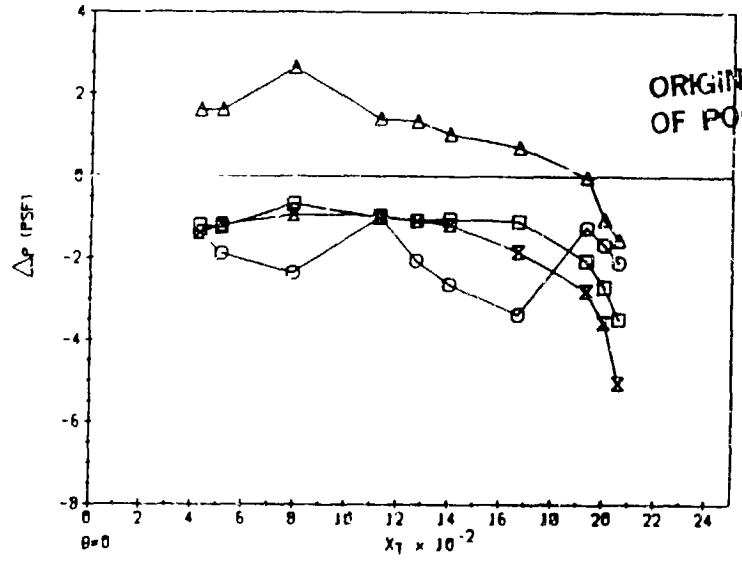
GROUP XXVII

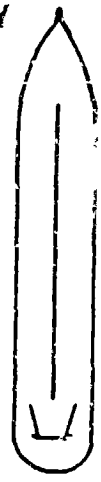
WIND DIRECTION EFFECTS AT 20 KT, HIGH FLOWRATE

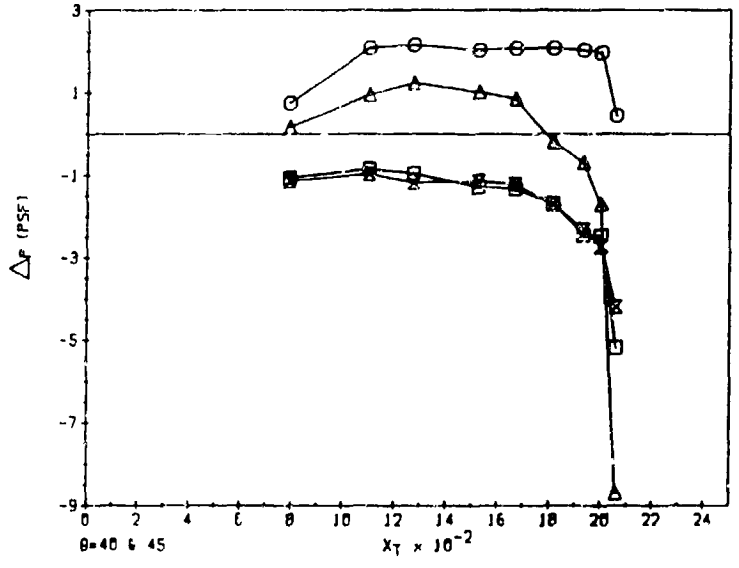
RUNS 40.2, 37.2, 38.2 and 39.2

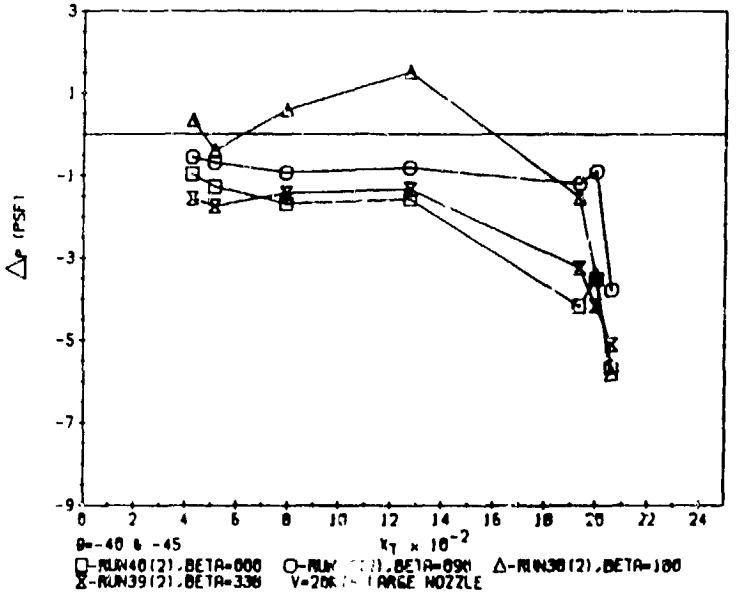
V = 20 KNOTS

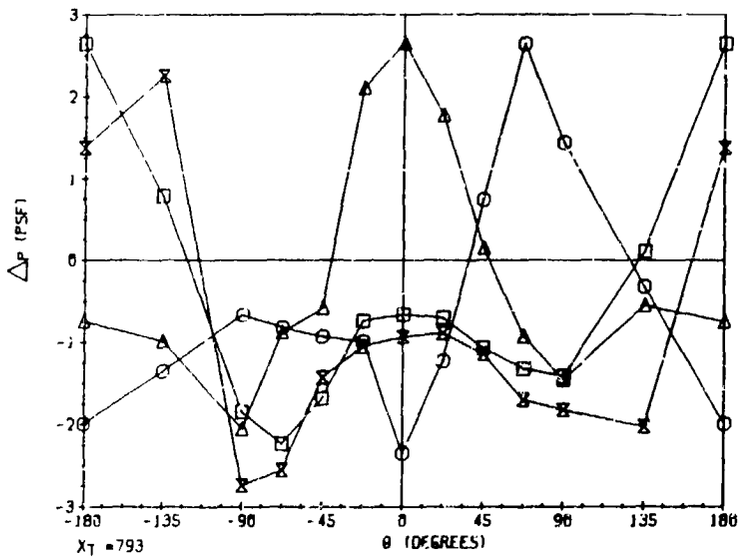
High Flowrate

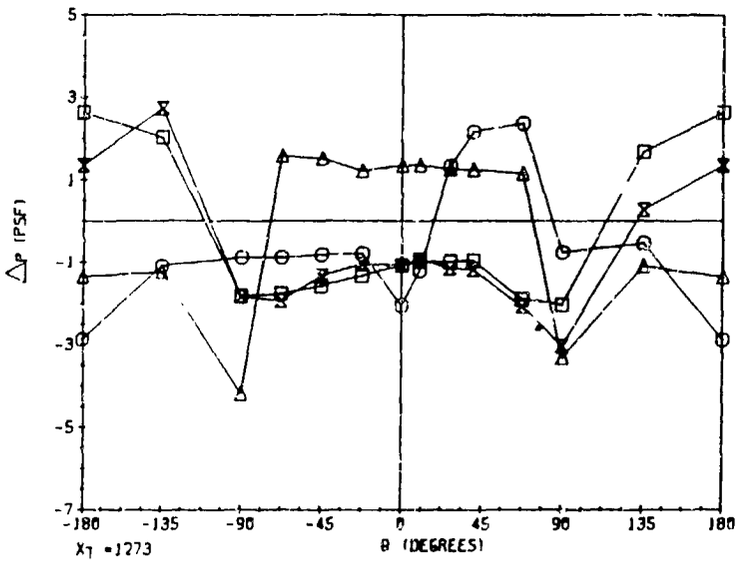


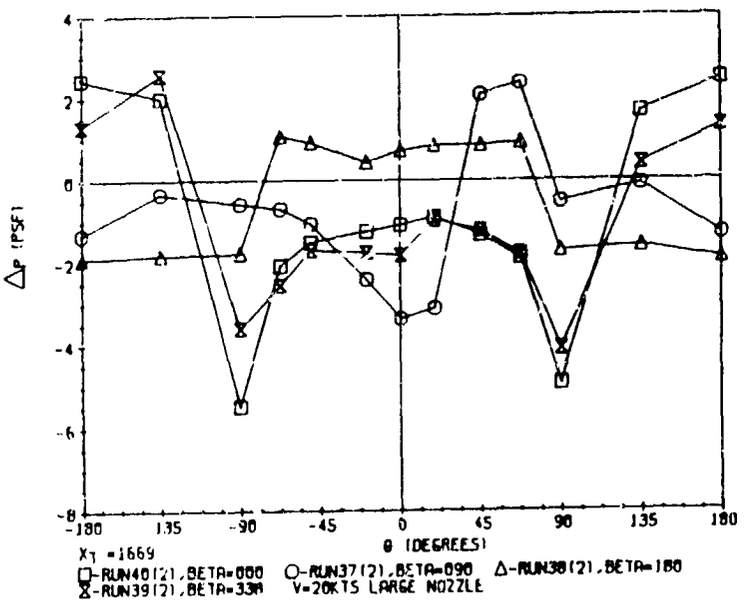


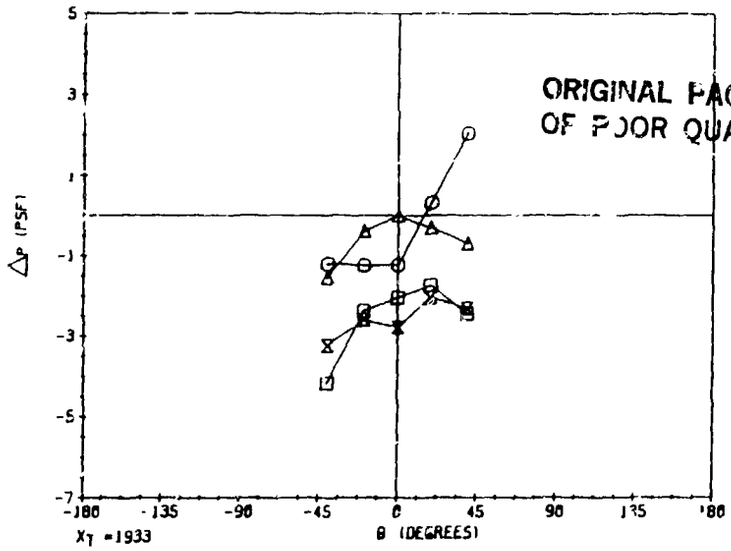


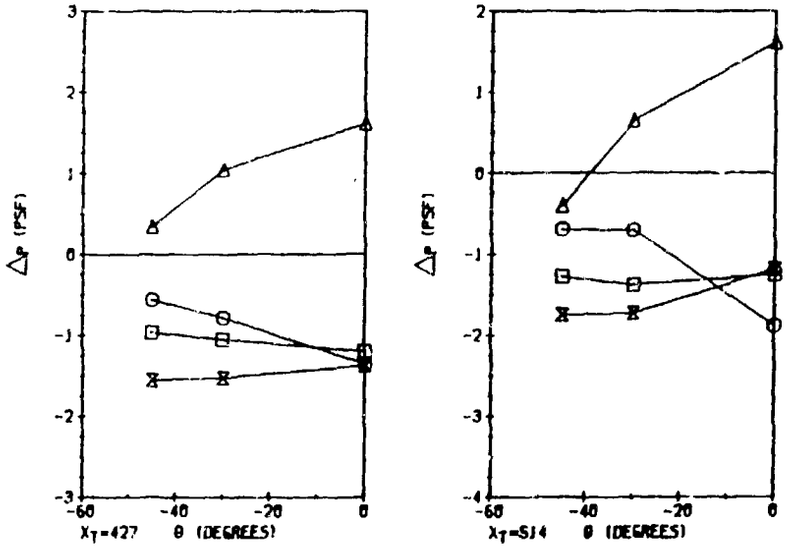












□-RUN40(2),BETA=000 ○-RUN37(2),BETA=090 Δ-RUN38(2),BETA=180
⧖-RUN39(2),BETA=330 V=20KTS LARGE NOZZLE

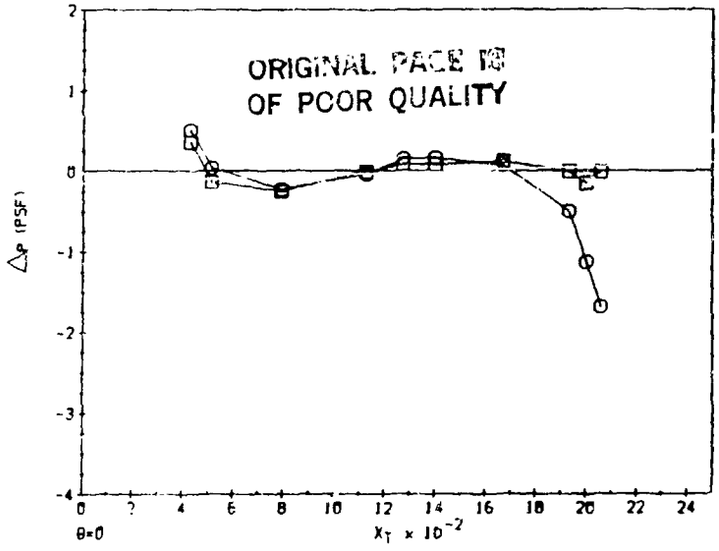
MARSHALL SPACE FLIGHT CENTER CONFIGURATION

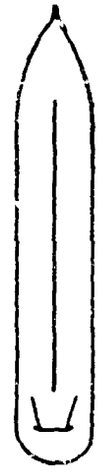
GROUP XXVIII

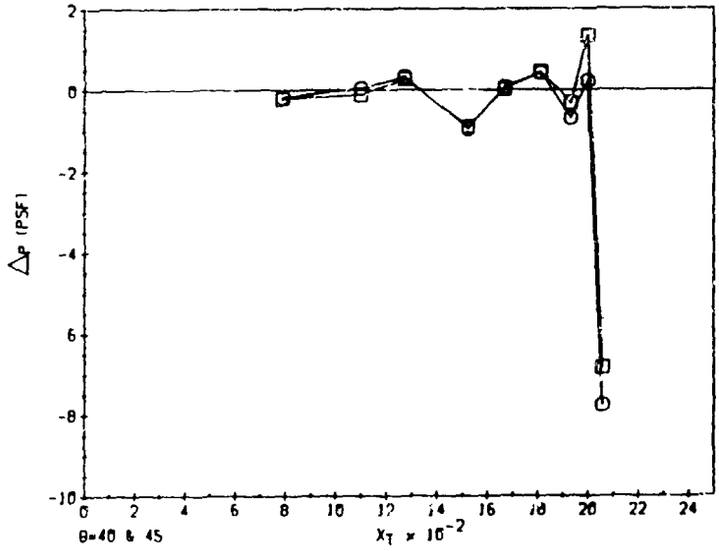
FLOWRATE EFFECTS, NO WIND

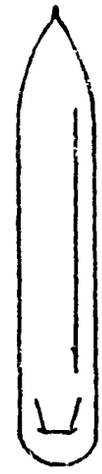
RUNS 32.1 and 32.2

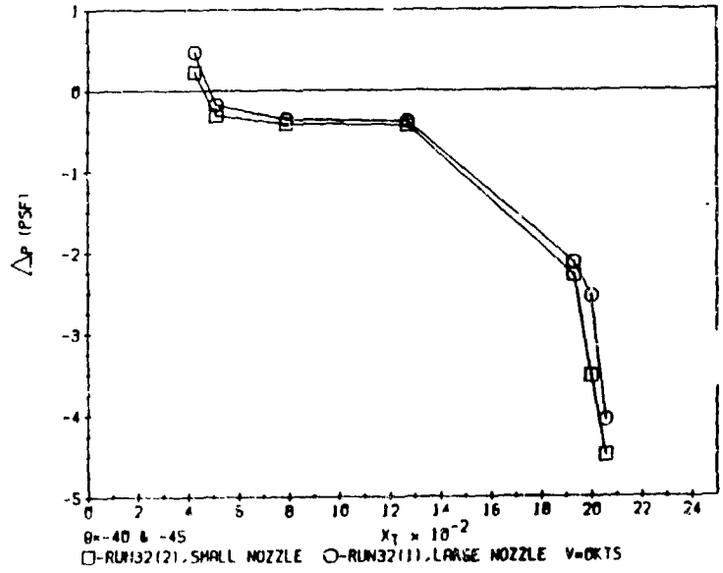
V = 0 KNOTS

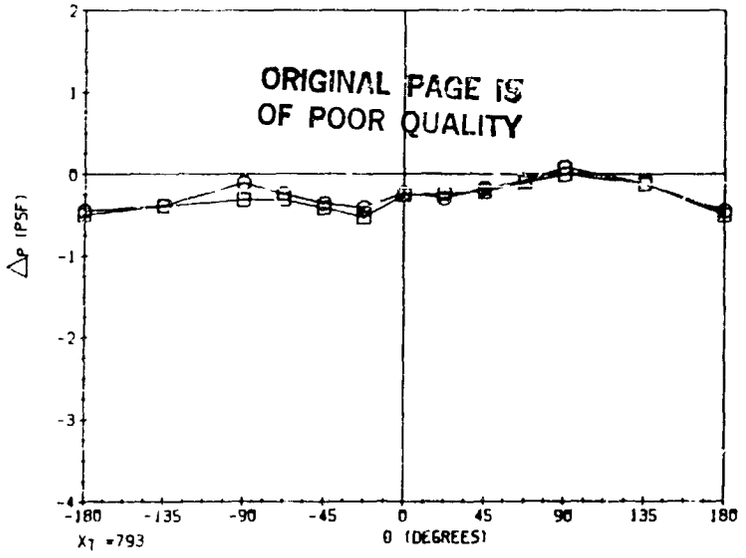


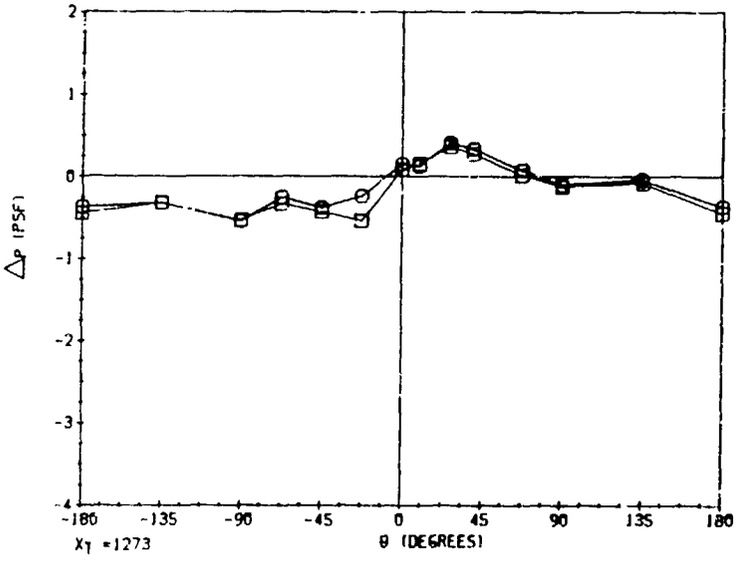


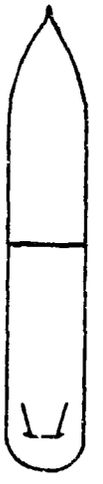


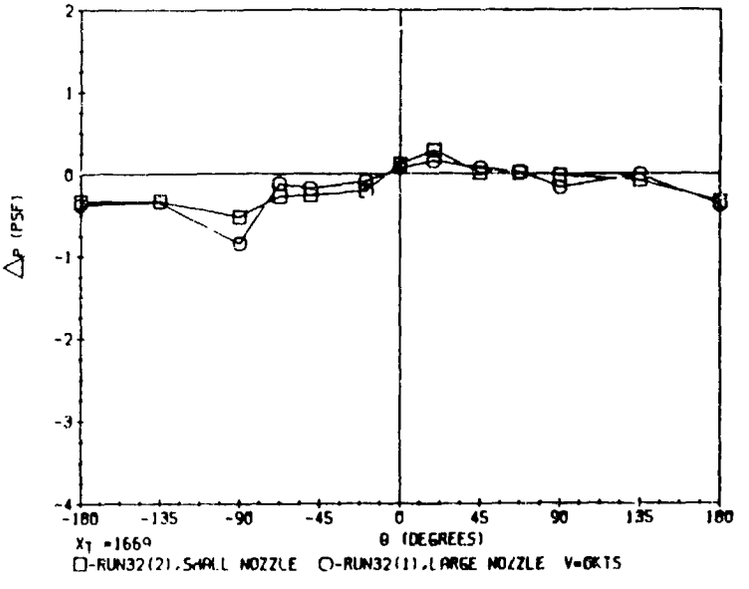


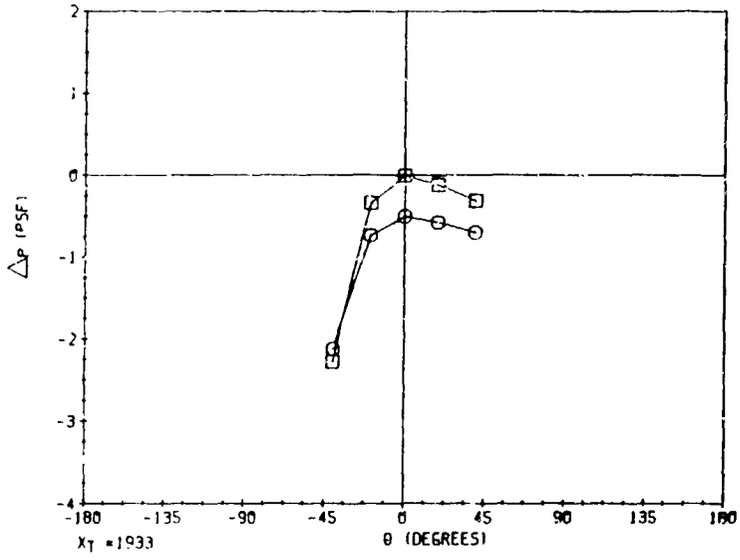


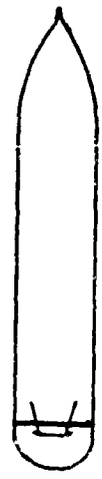


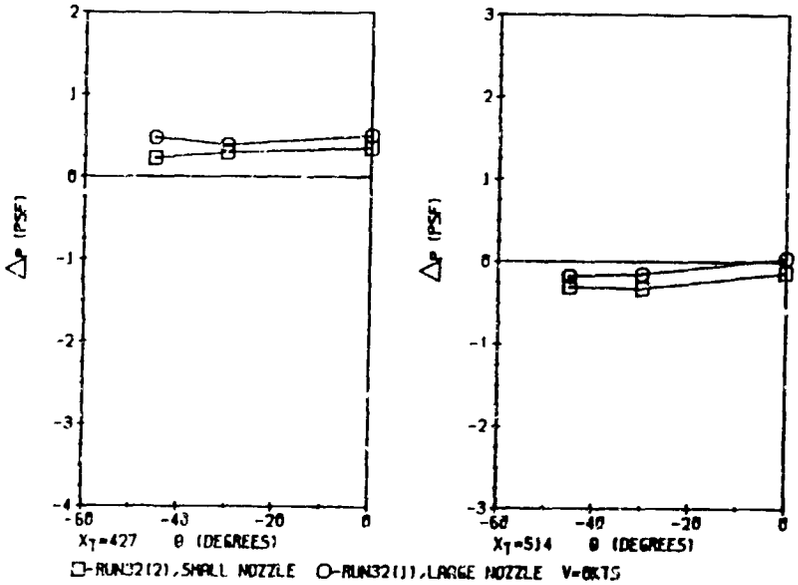








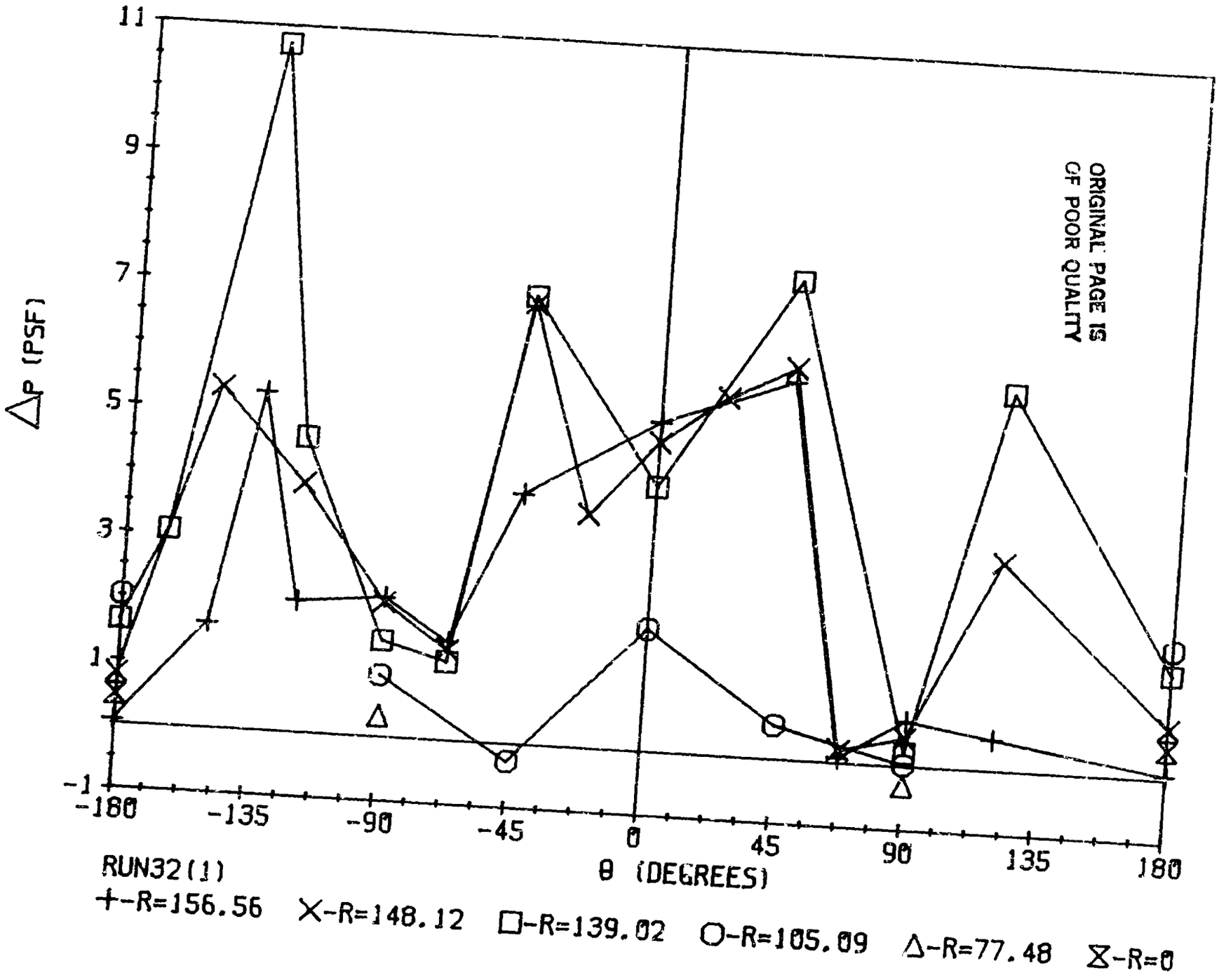




HOT FILM DATA

MARSHALL SPACE FLIGHT CENTER CONFIGURATION

BASE PRESSURE DATA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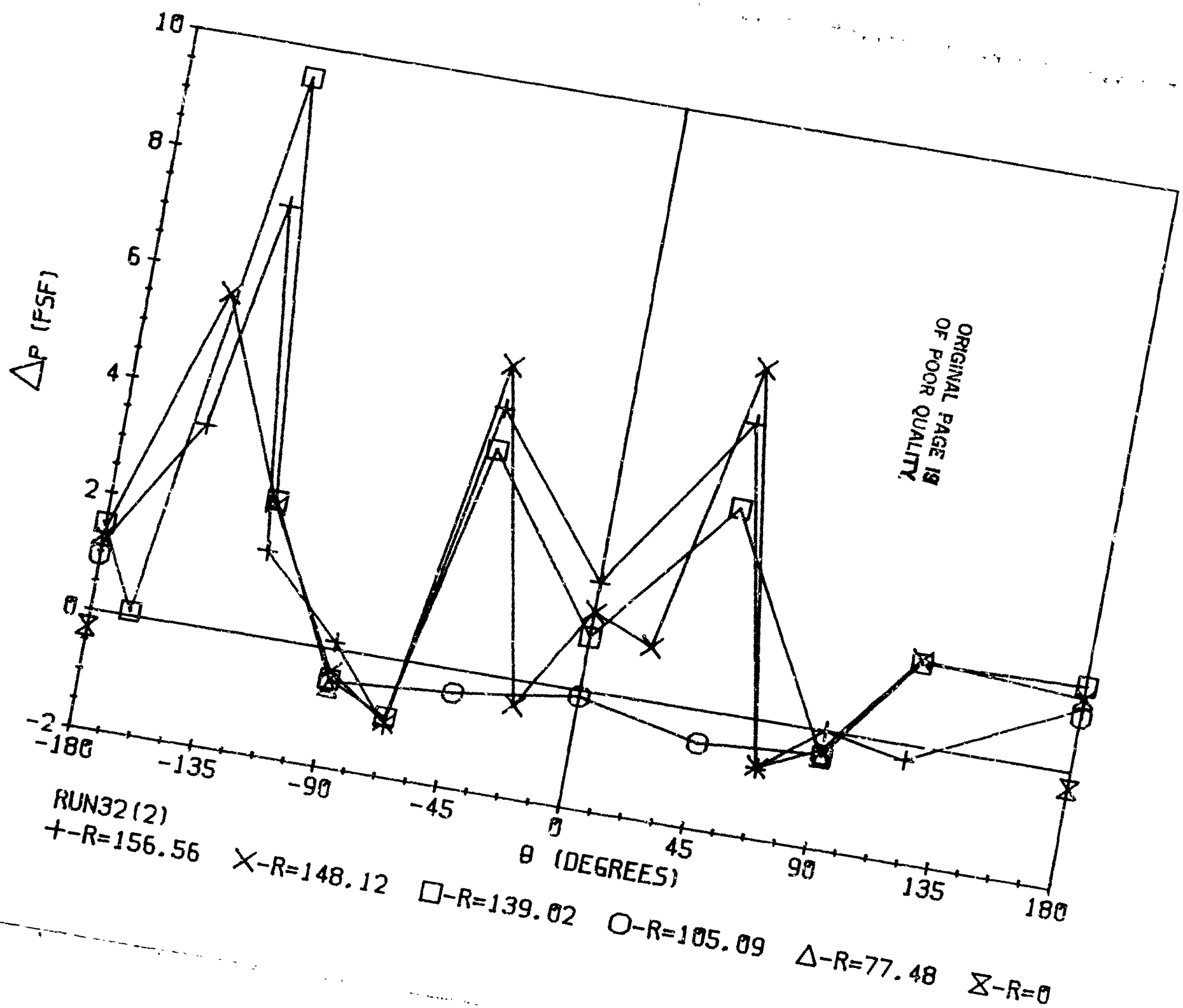
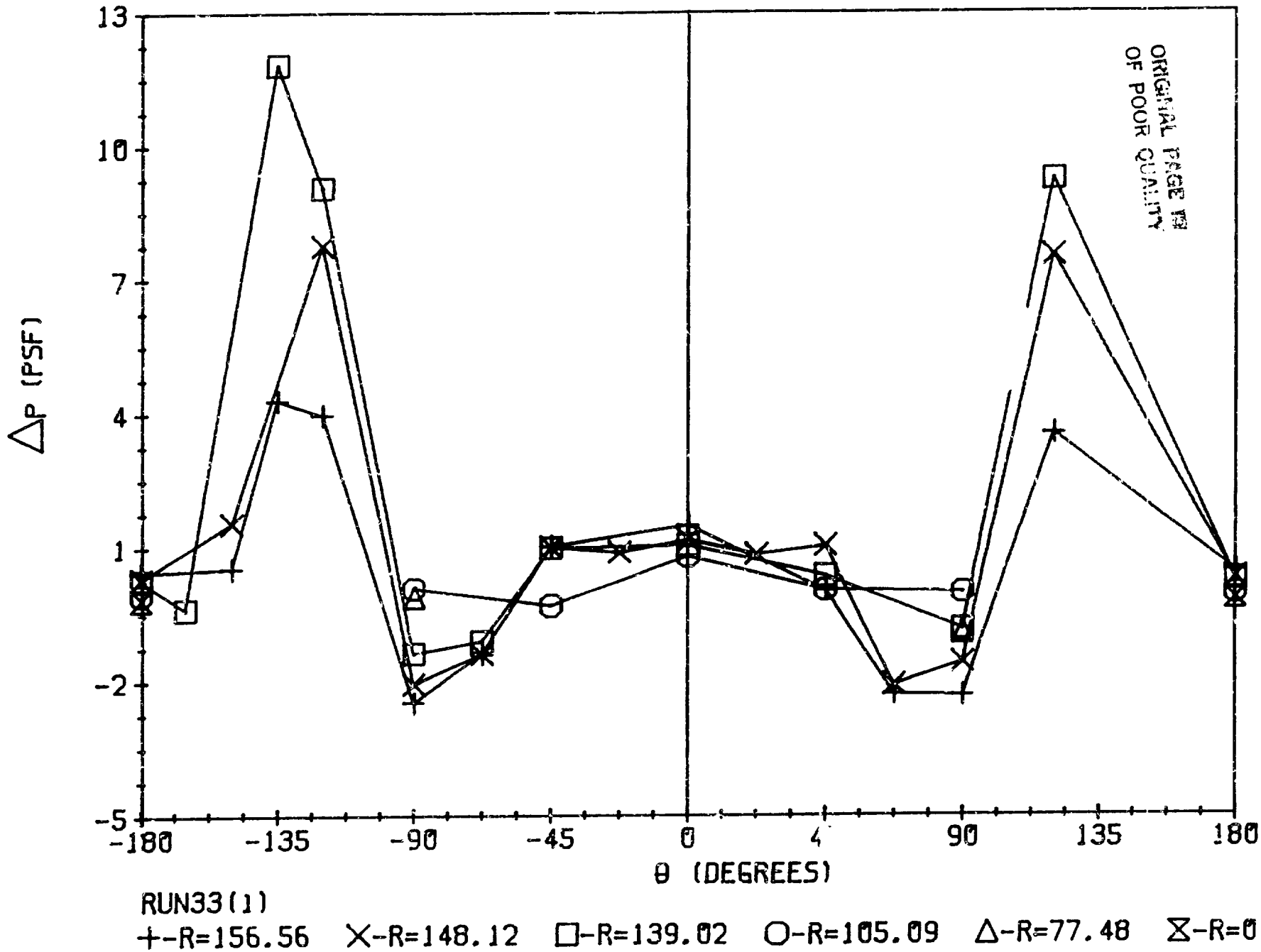
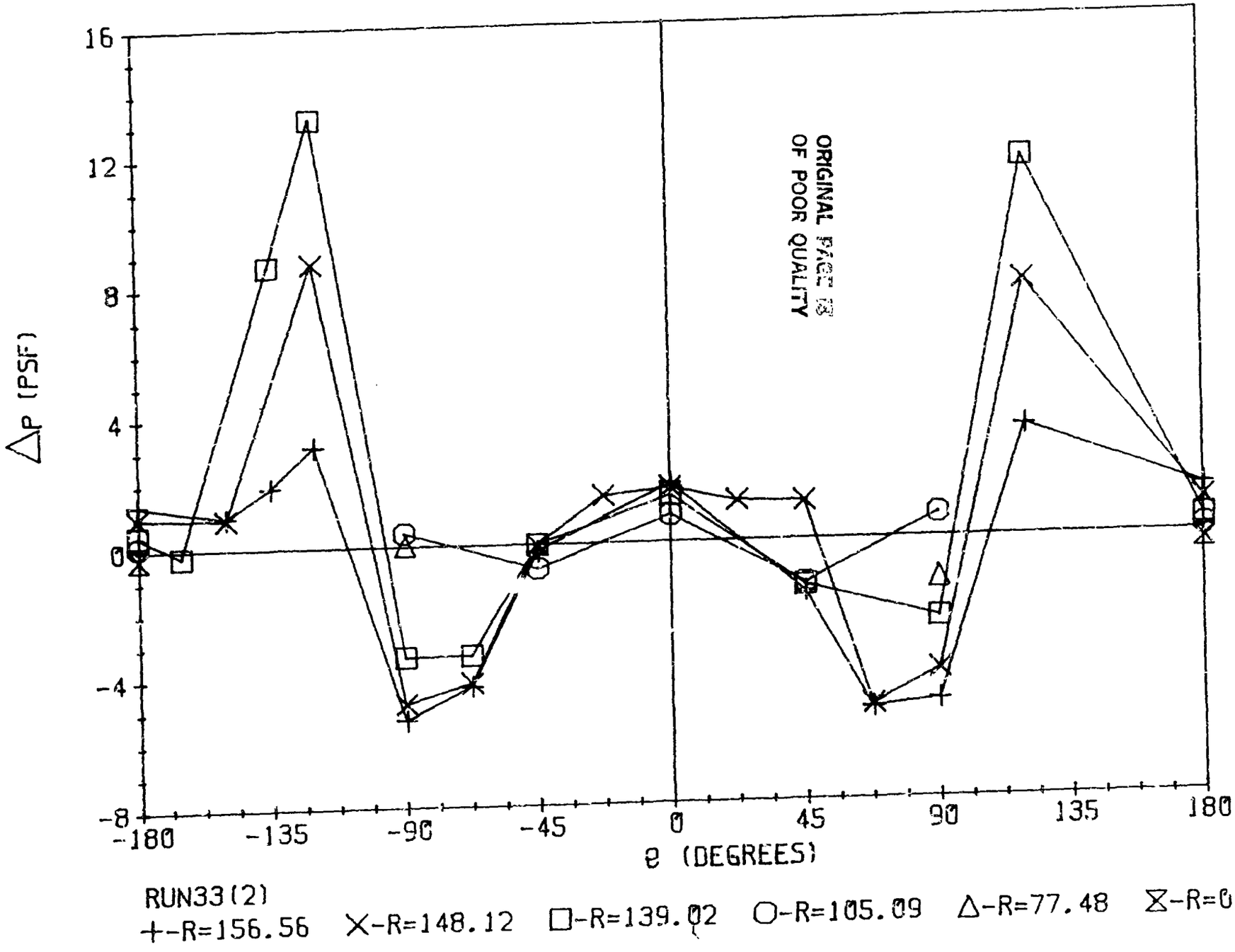
9
7
5
3
1
-1
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN32(1)
+-R=156.56
X-R=148.12
□-R=139.02
O-R=105.09
Δ-R=77.48
⧖-R=0




13
10
7
4
1
-2
-5
ΔP (PSF)
-180
-135
-90
-45
0
4
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN33(1)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
Δ-R=77.48
⧖-R=0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12
8
4
0
-4
-8
ΔP (PSF)
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-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN33(2)
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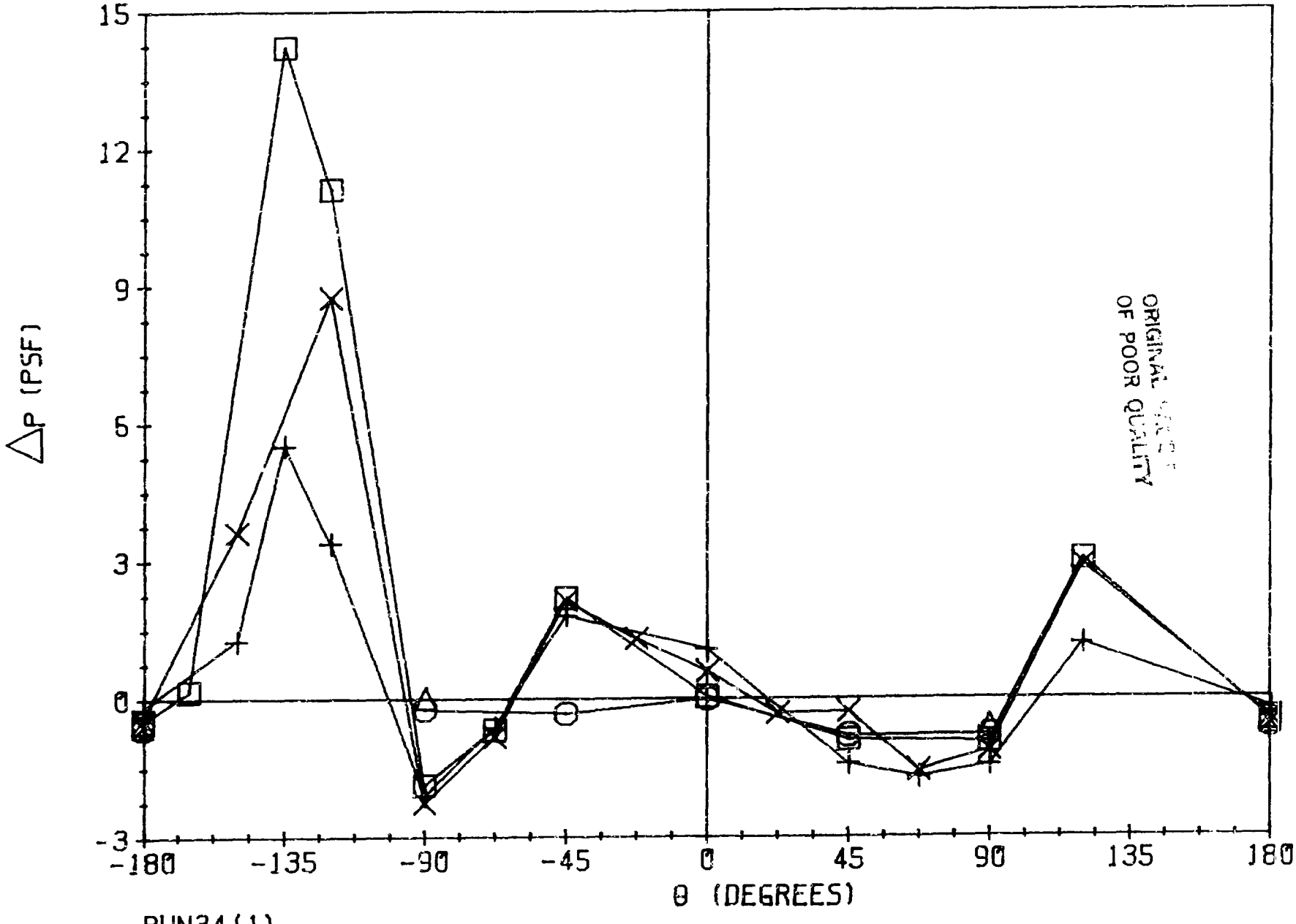
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0


15
12
9
6
3
0
-3
ΔP (PSF)
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-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
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□-R=139.02
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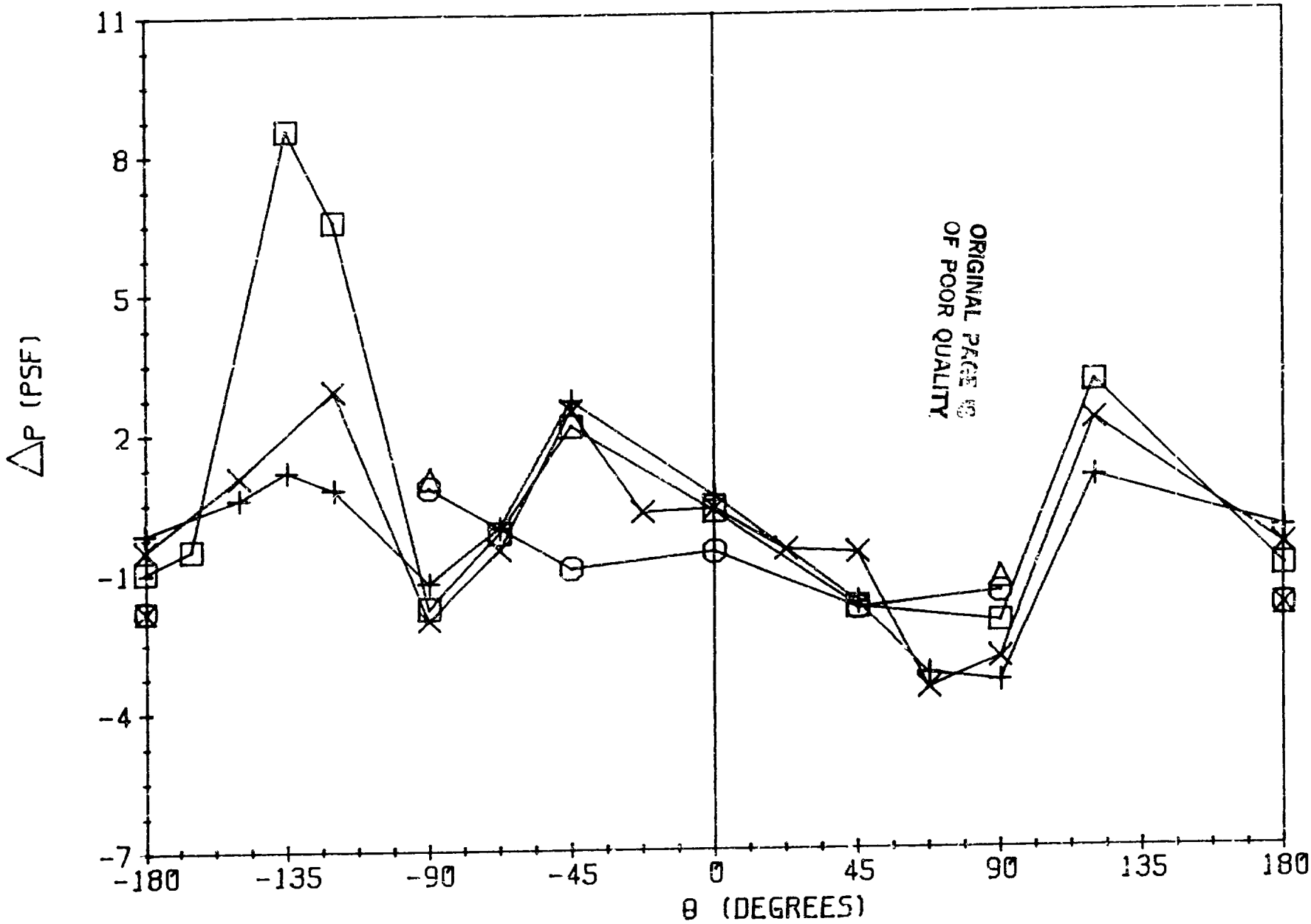
△-R=77.48
⧖-R=0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8
5
2
-1
-4
-7
ΔP (PSF)
-180
-135
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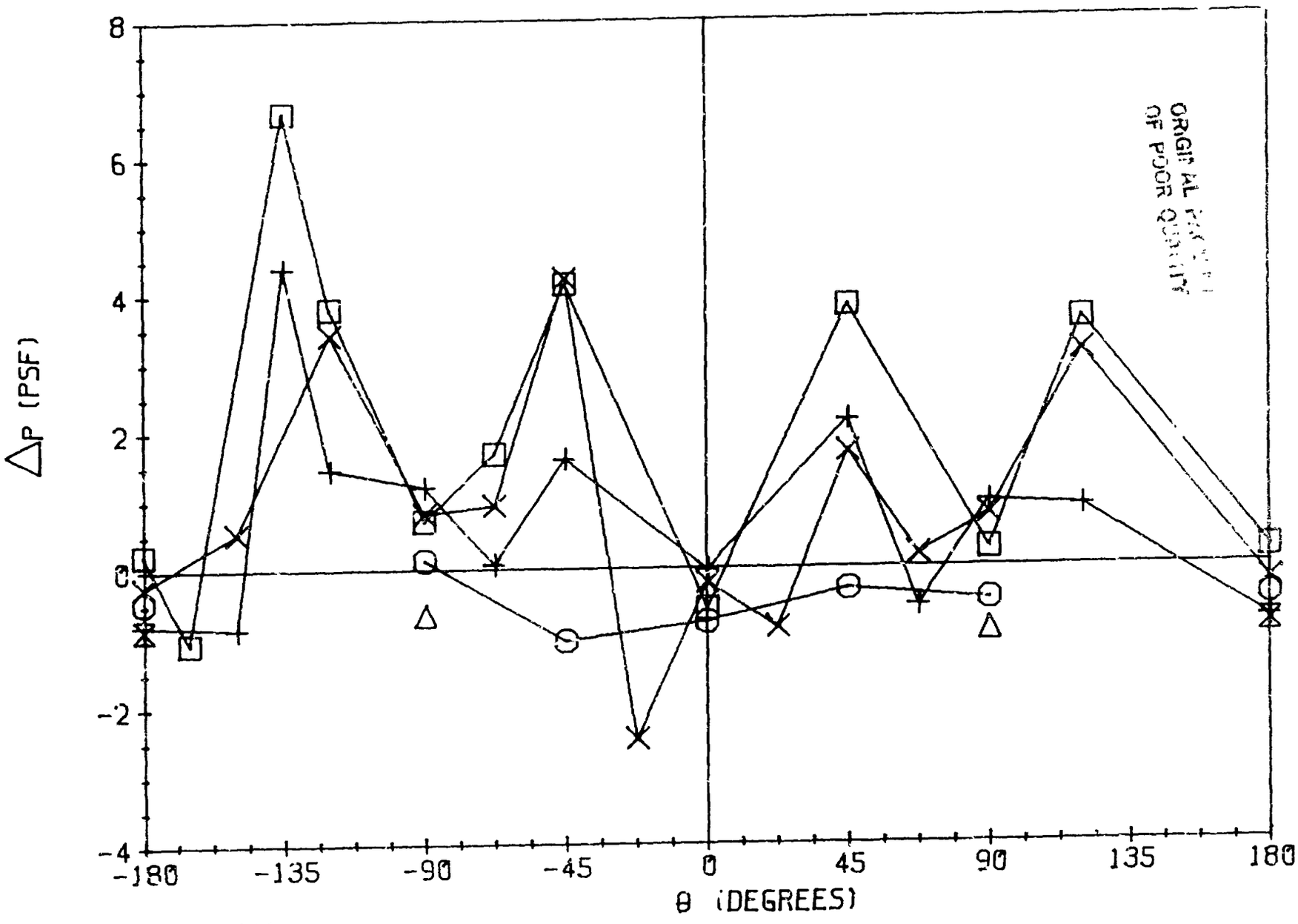
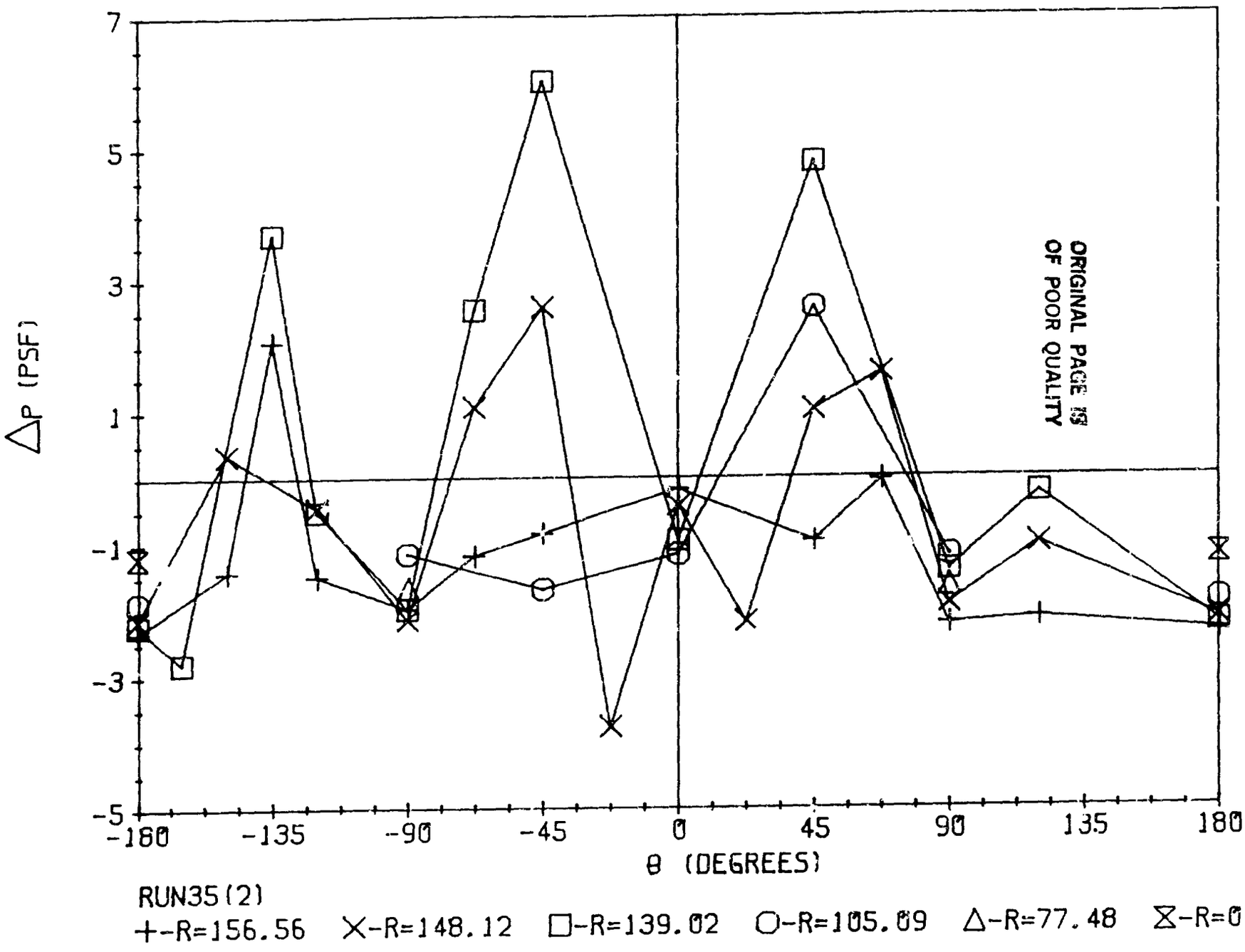
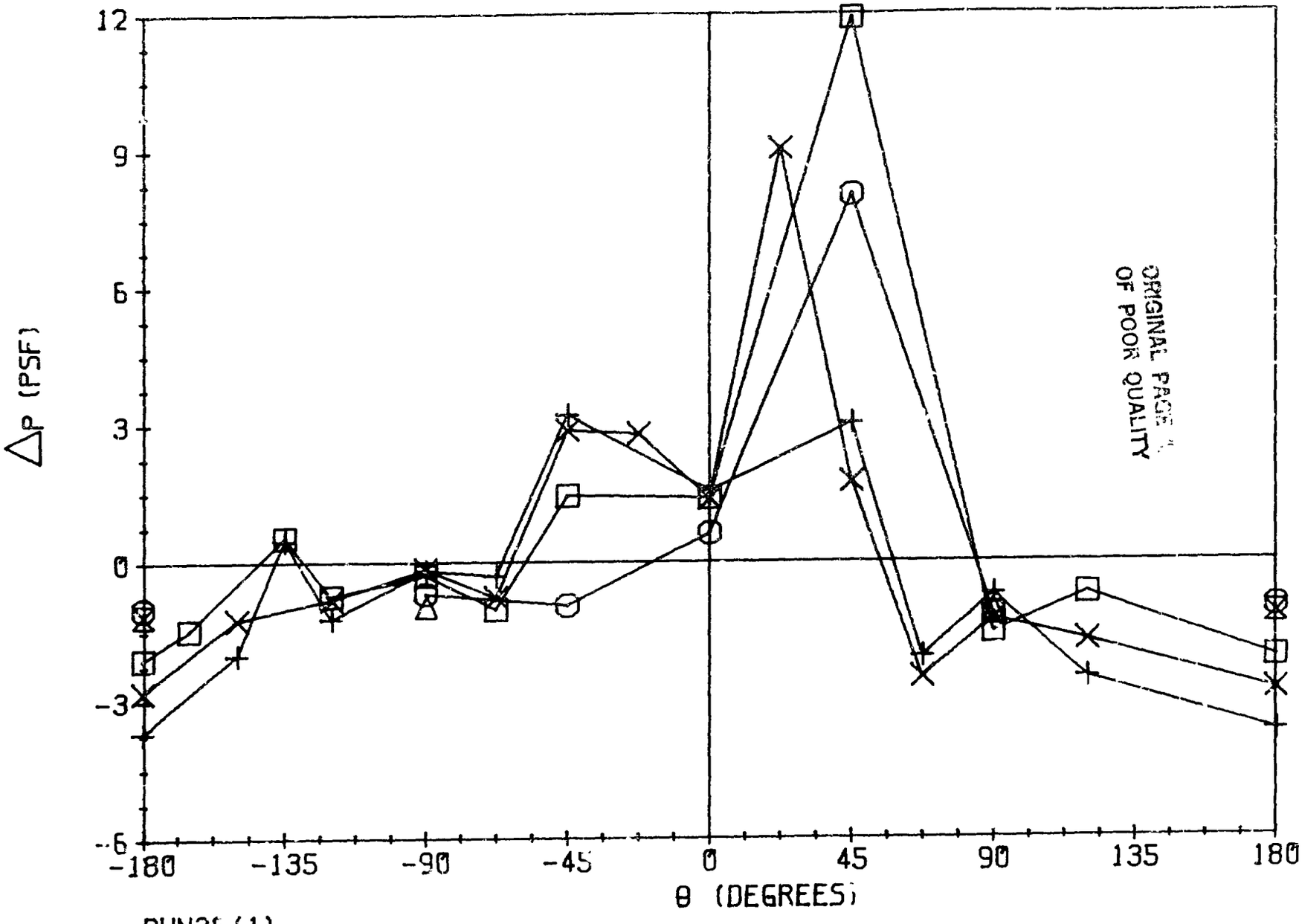
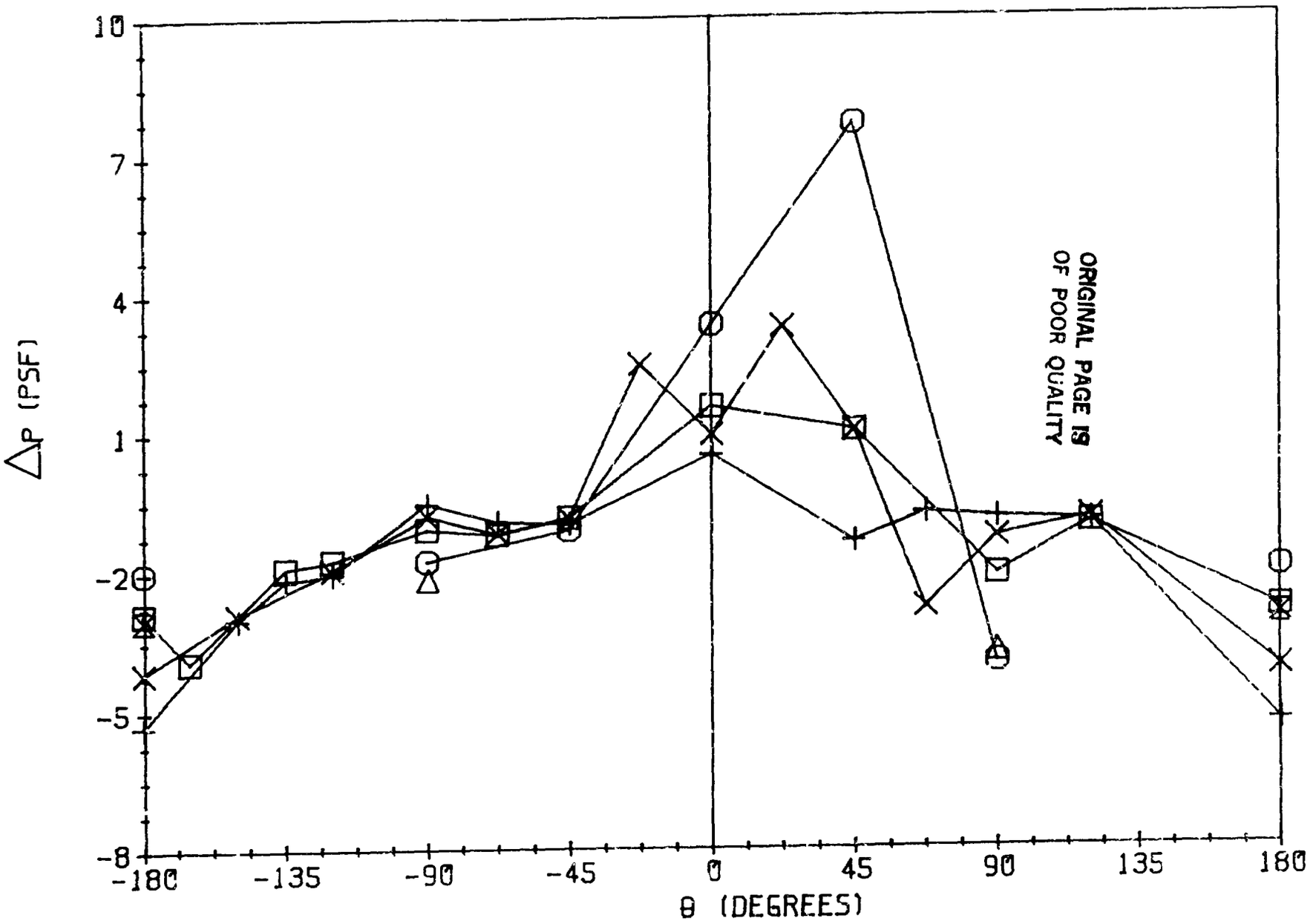
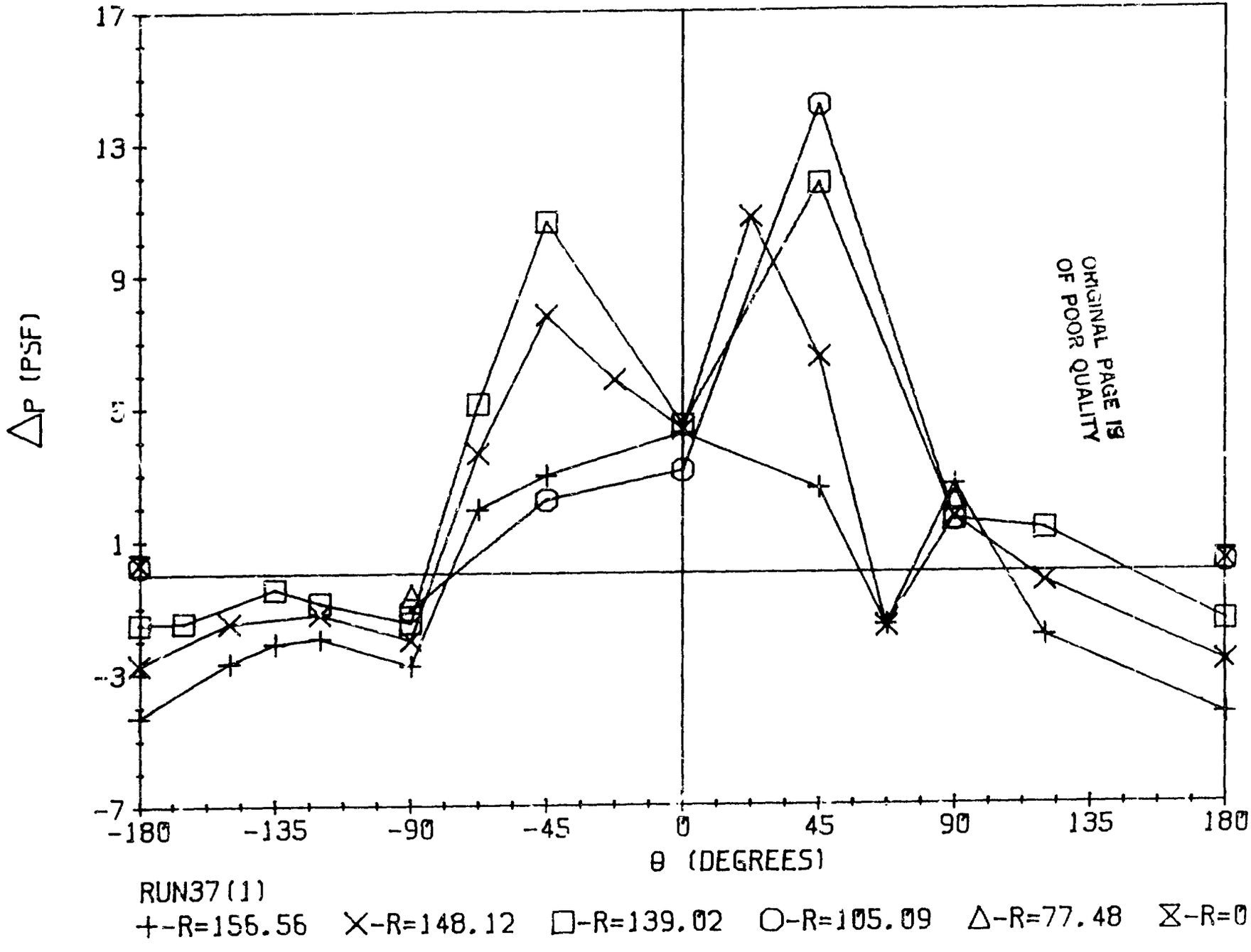
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN34(2)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
Δ-R=77.48
⧖-R=0

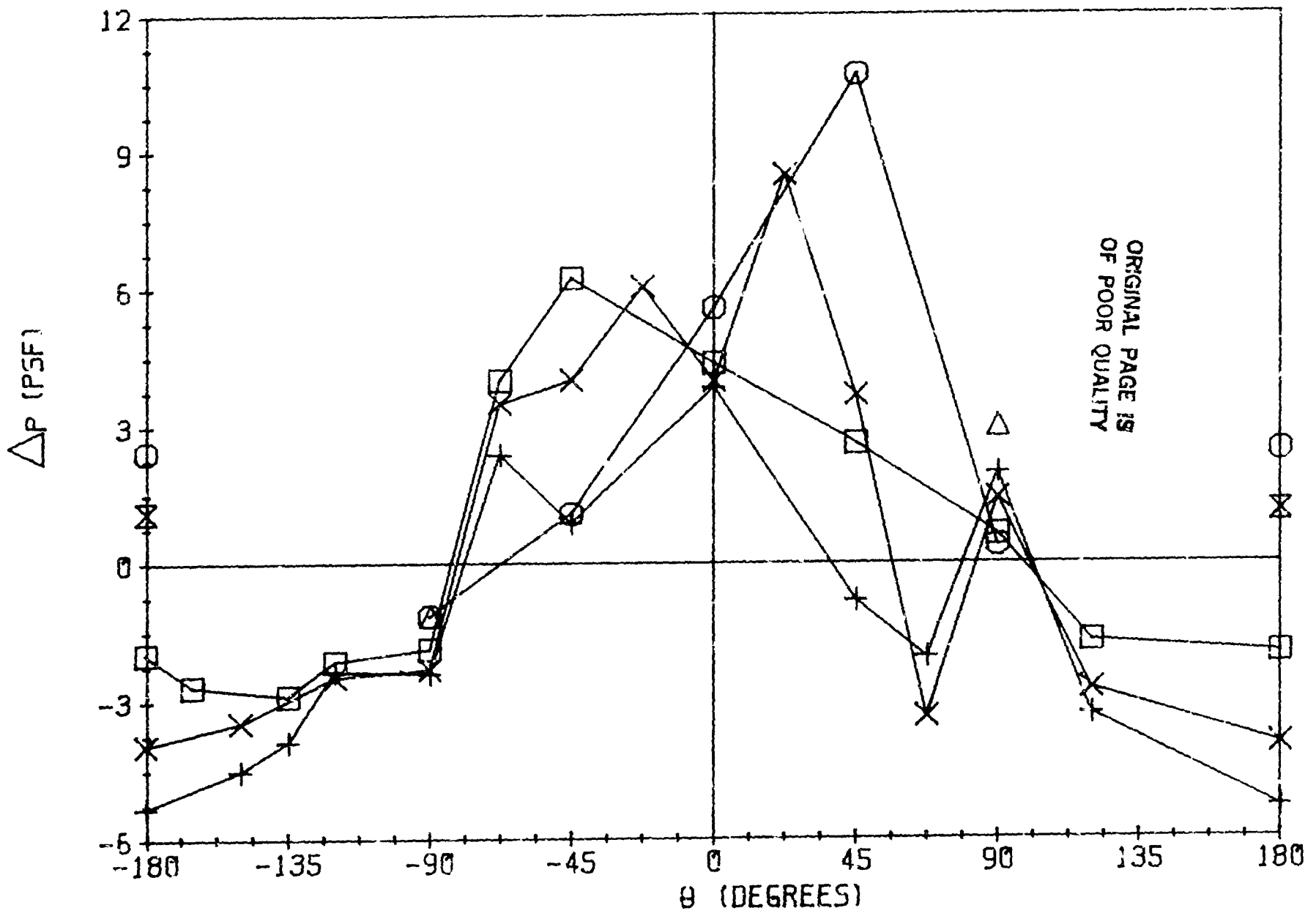

8
6
4
2
0
-2
-4
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
RUN35(1)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0

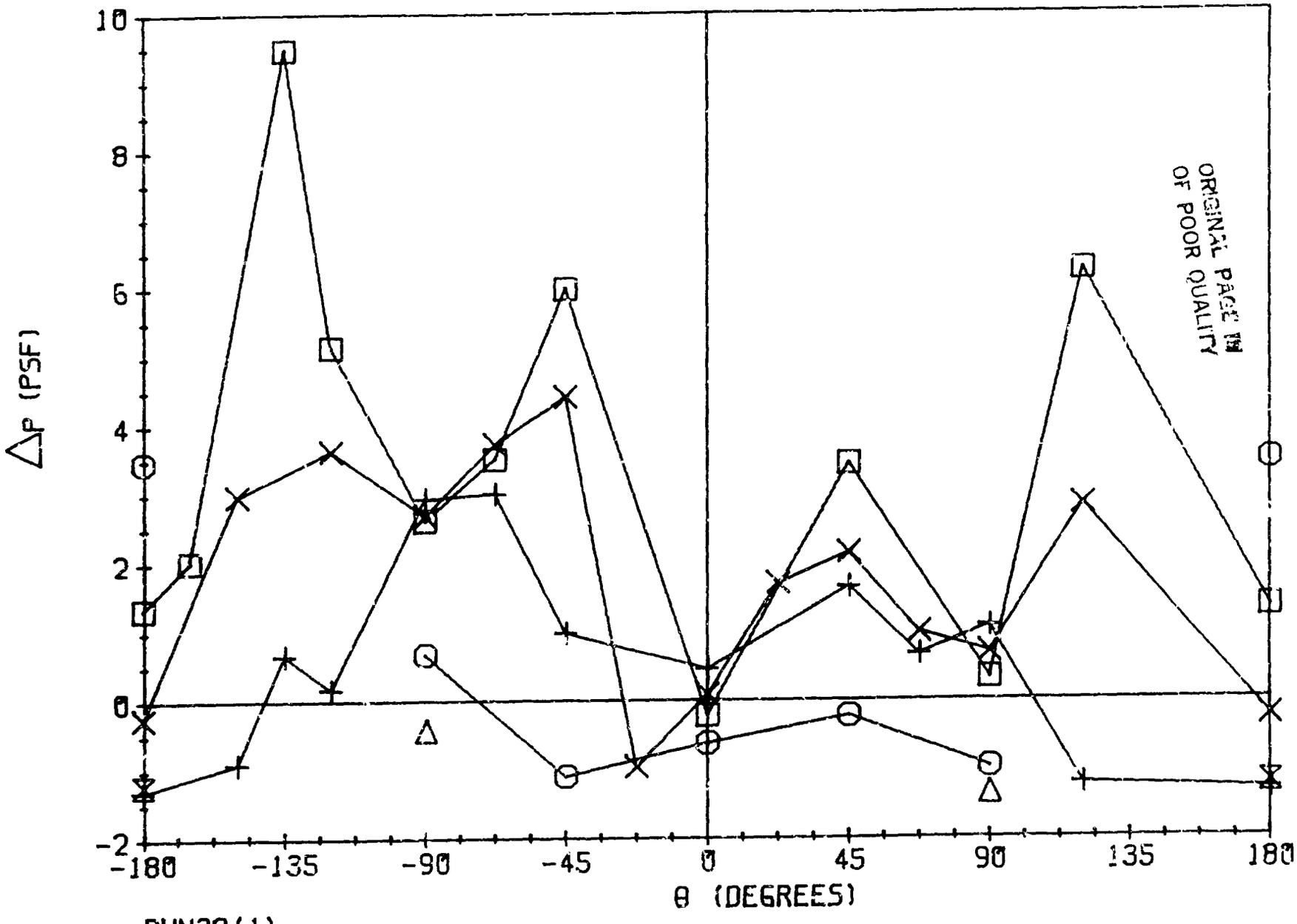

7
5
3
1
-1
-3
-5
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN35(2)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0

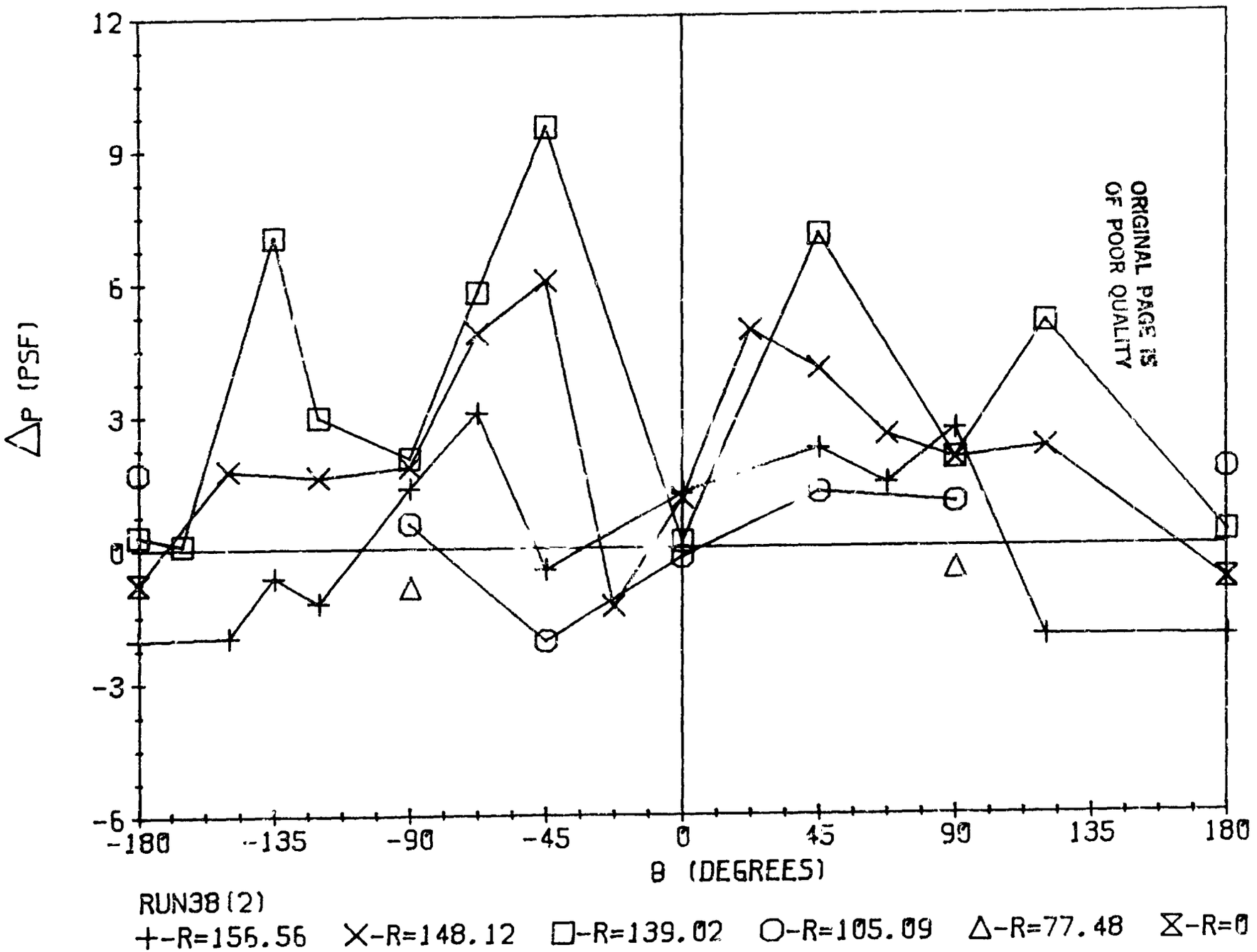

12
9
6
3
0
-3
-6
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN36(1)
+--R=156.56
X--R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0

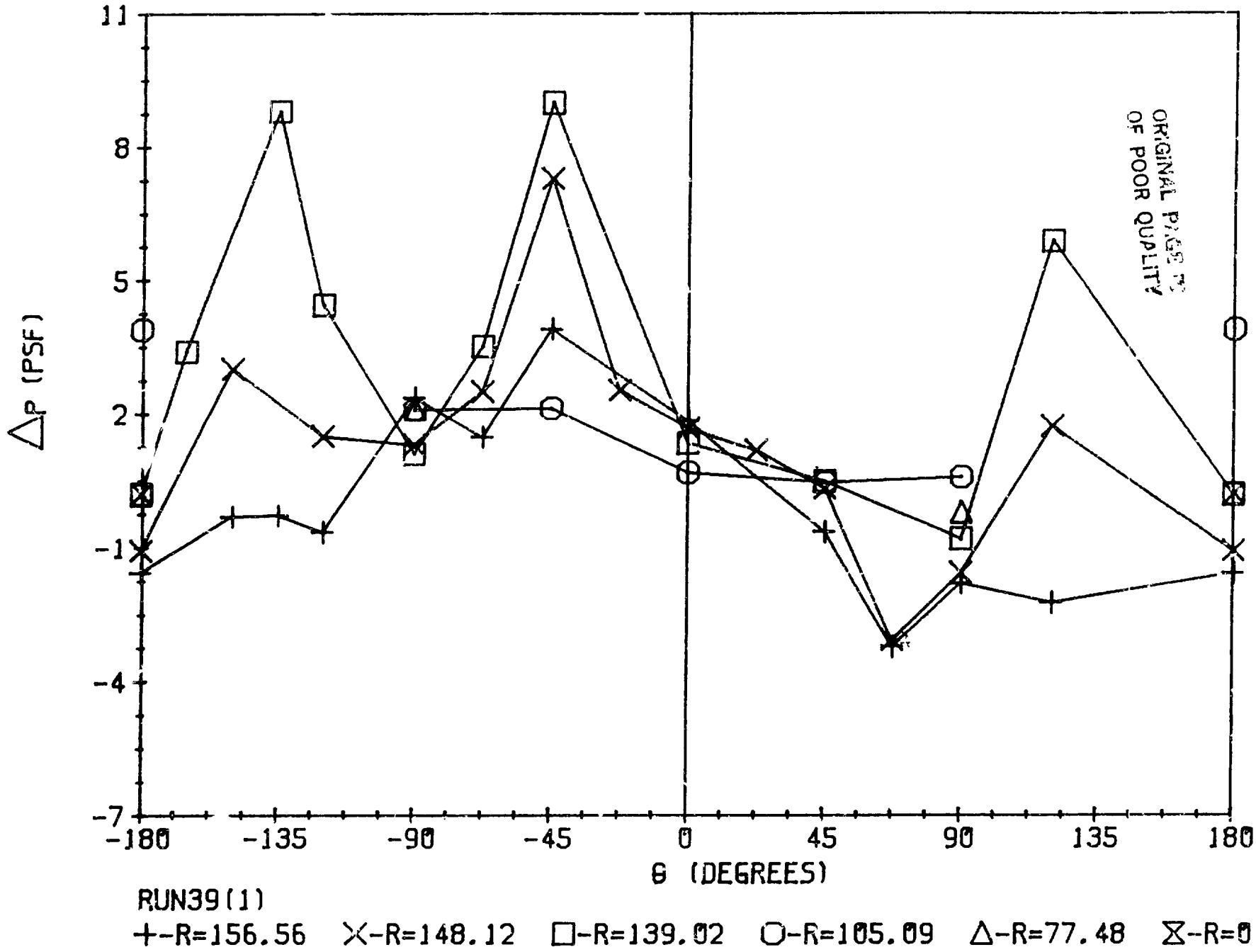

10
7
4
1
-2
-5
-8
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN36(2)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0

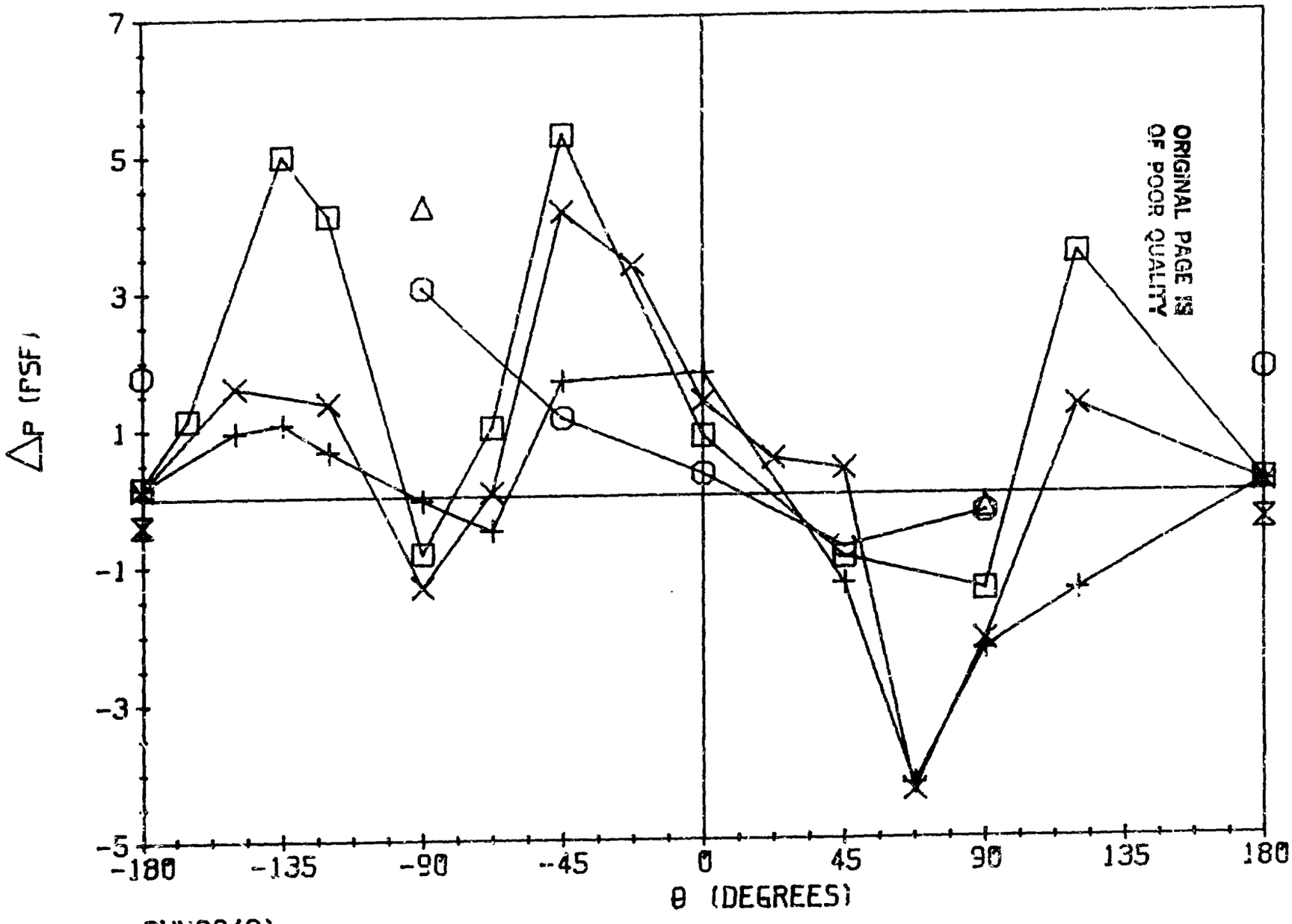

17
13
9
1
-3
-7
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN37(1)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0




10
8
6
4
2
0
-2
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN38(1)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0

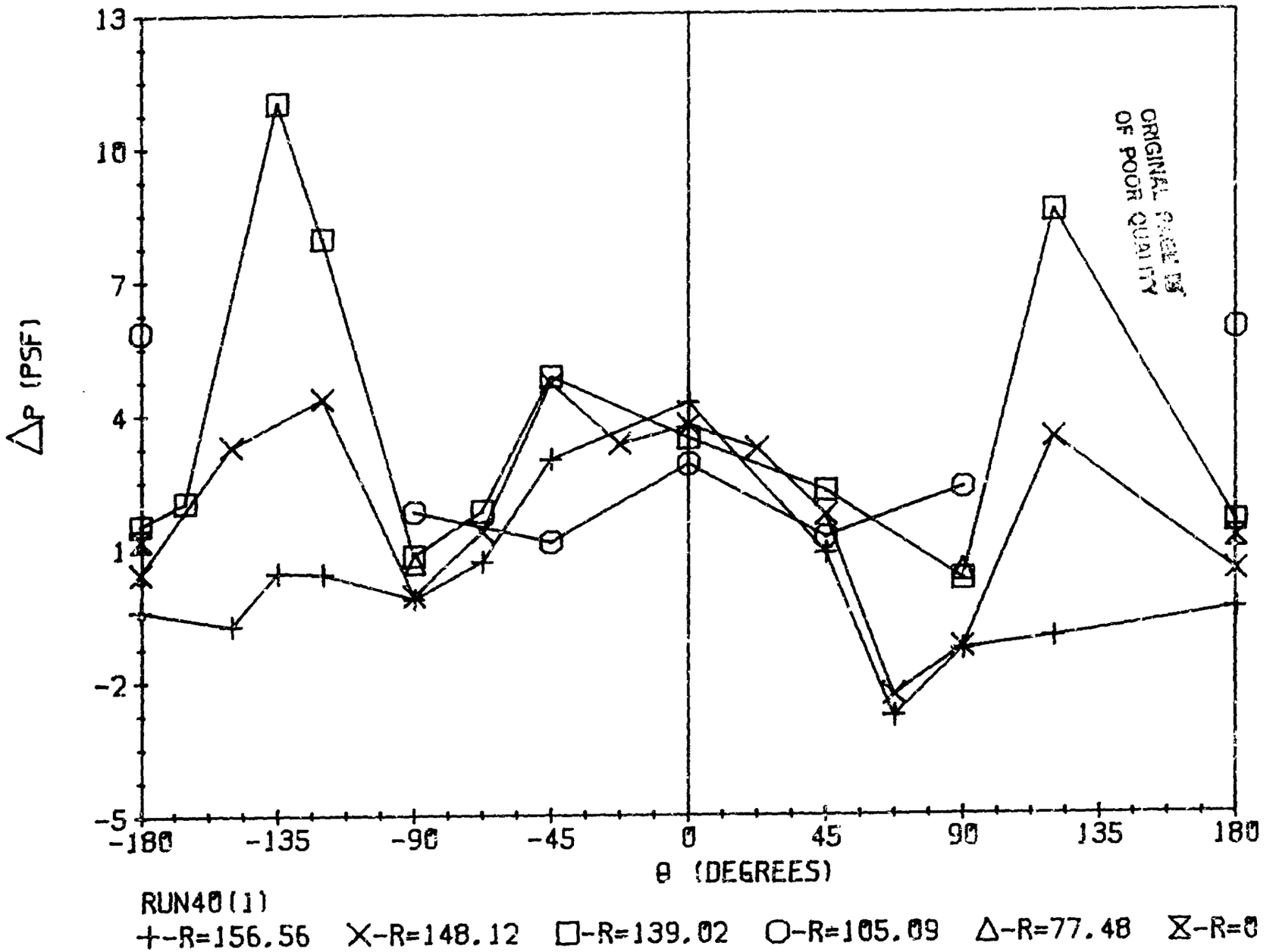

12
9
6
3
0
-3
-6
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN38(2)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0

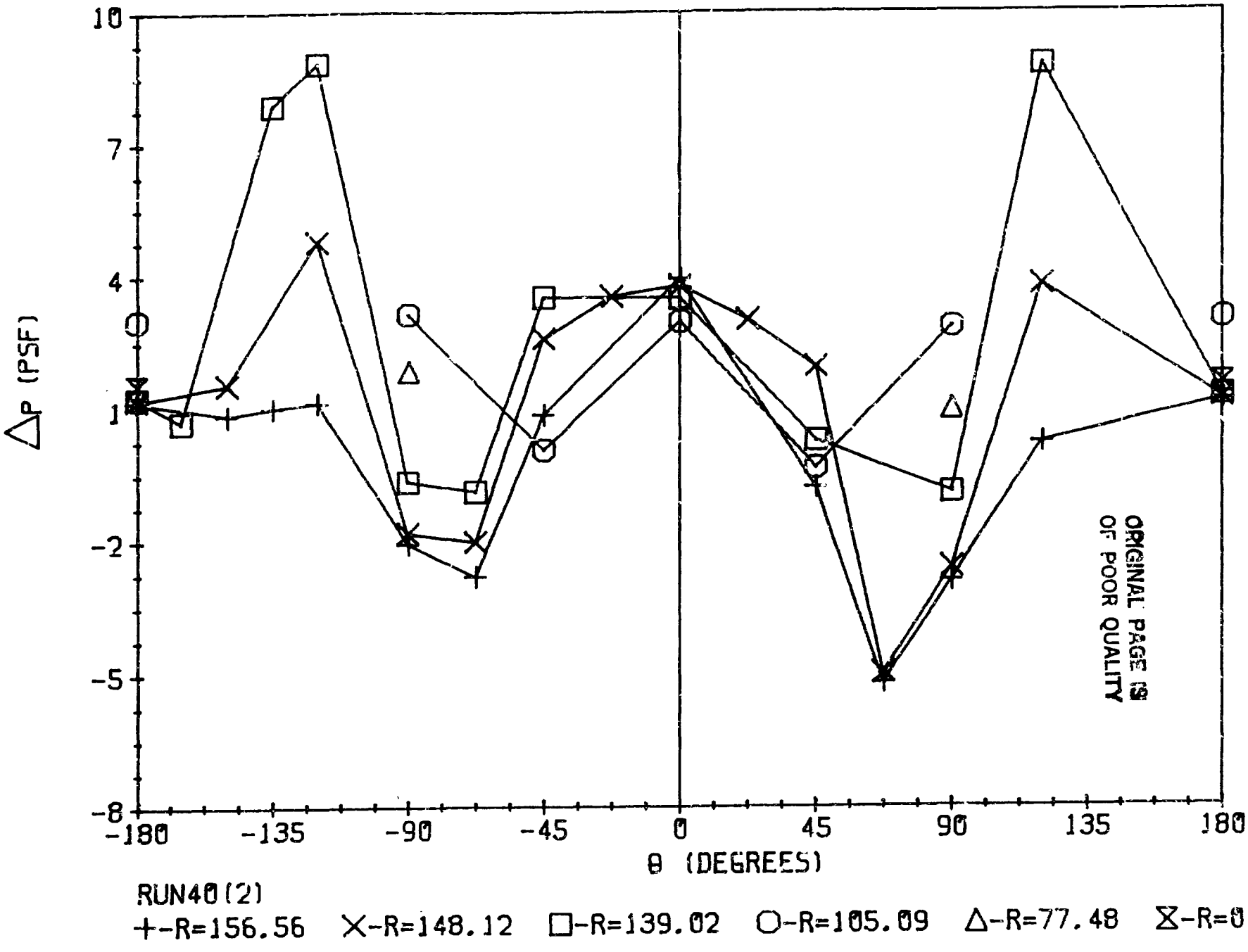

11
8
5
2
-1
-4
-7
ΔP (PSF)
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
ORIGINAL PAGE IS
OF POOR QUALITY
RUN39(1)
+-R=156.56
X-R=148.12
□-R=139.02
○-R=105.09
△-R=77.48
⧖-R=0



RUN39(2)

+-R=156.56 X-R=148.12 □-R=139.02 ○-R=105.09 △-R=77.48 ⧖-R=0



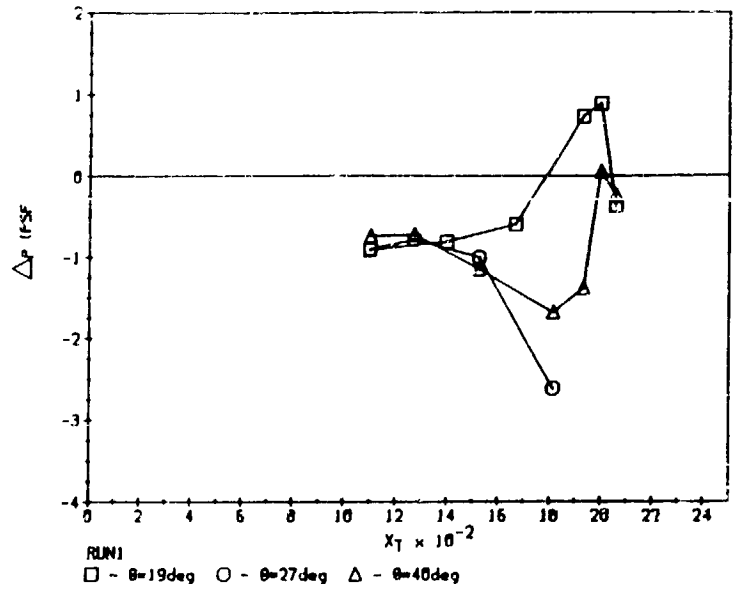


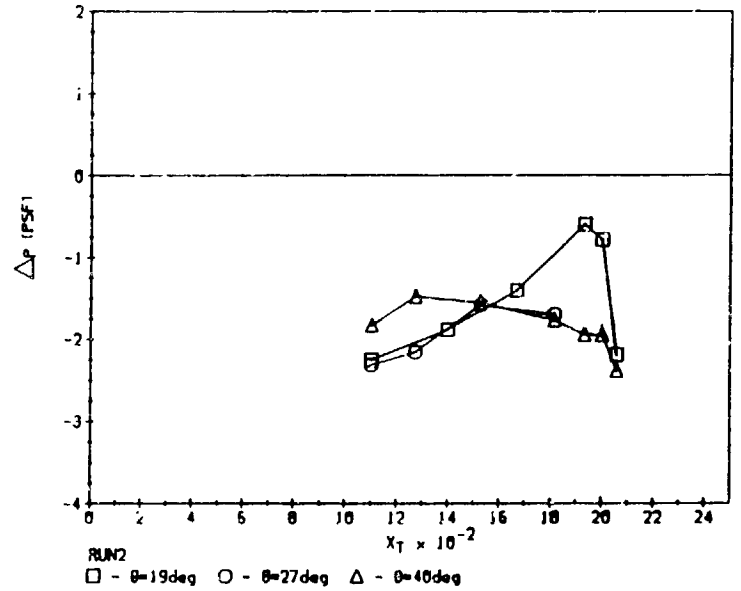
FEEDLINE AND CABLE TRAY

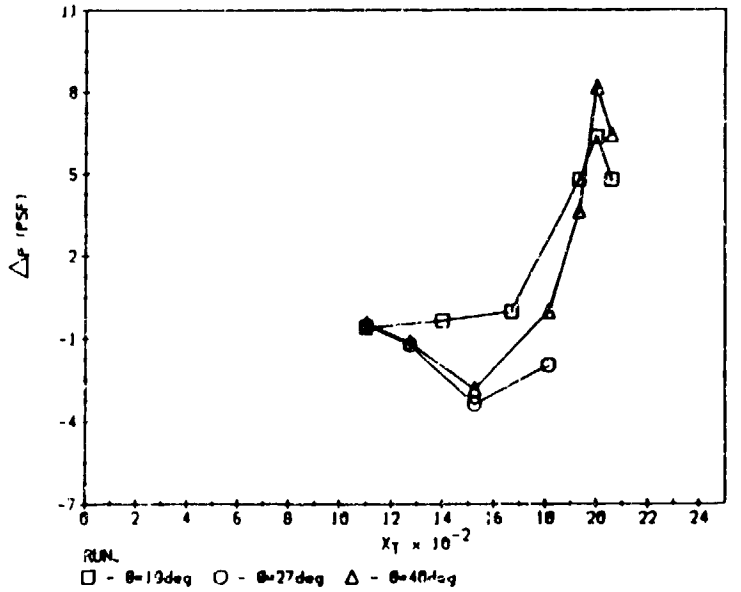
PRESSURE DATA

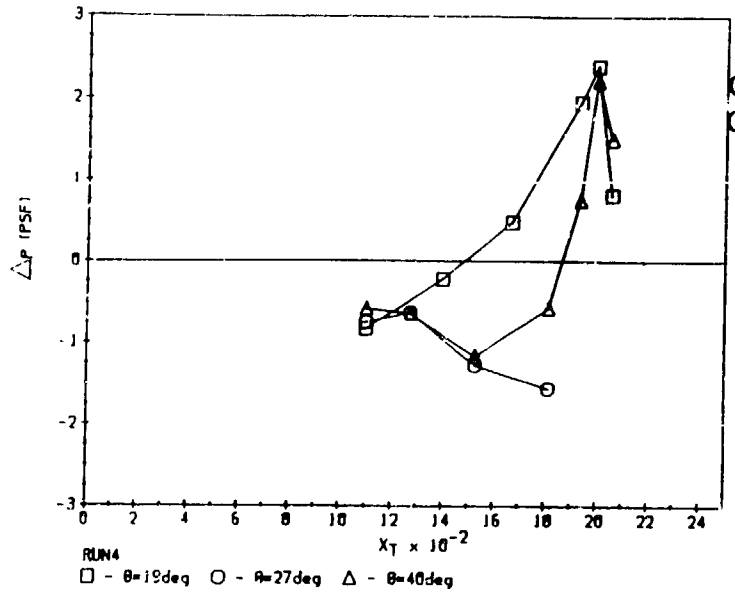
ALL CONFIGURATIONS

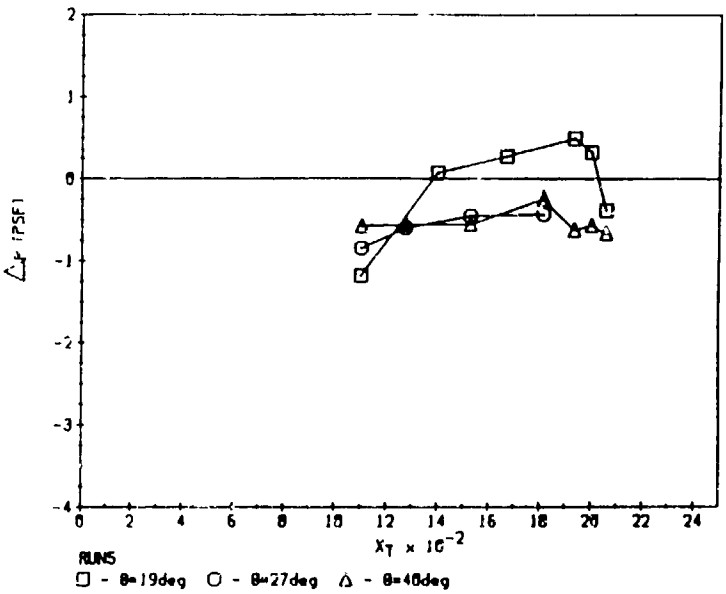
ALL RUNS

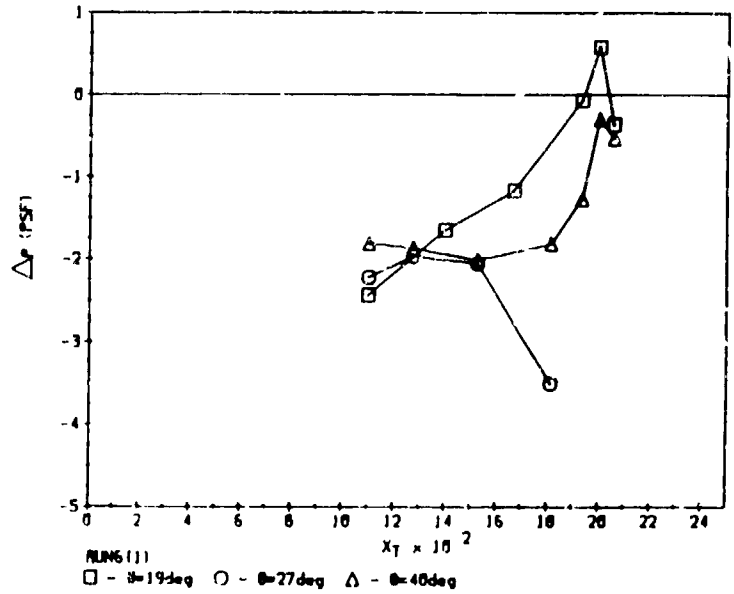


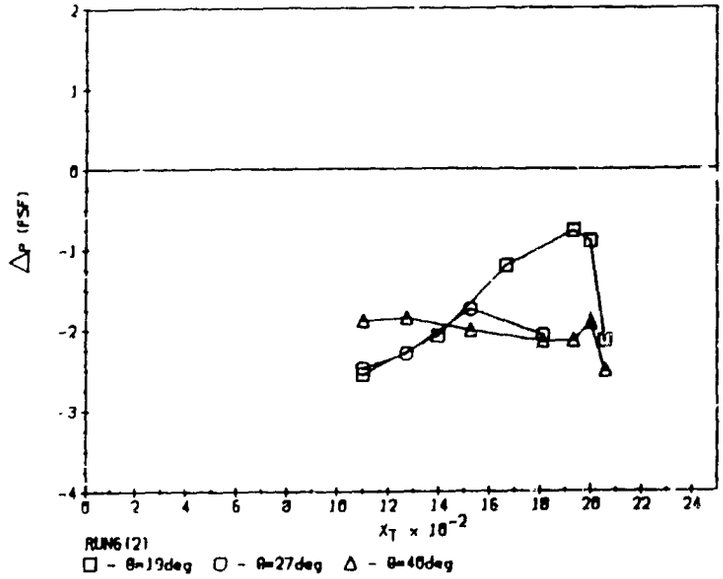


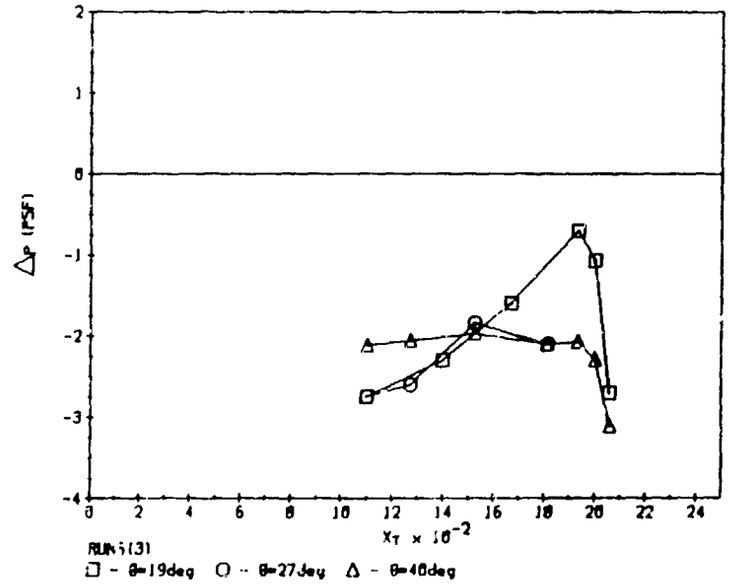


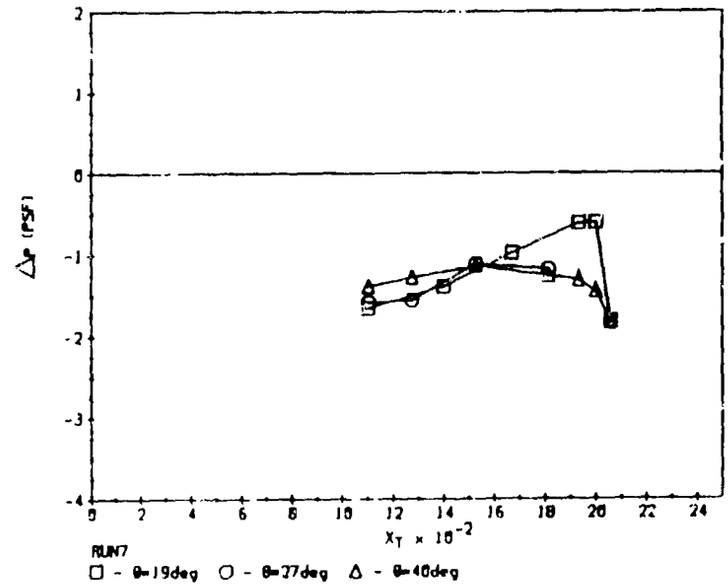


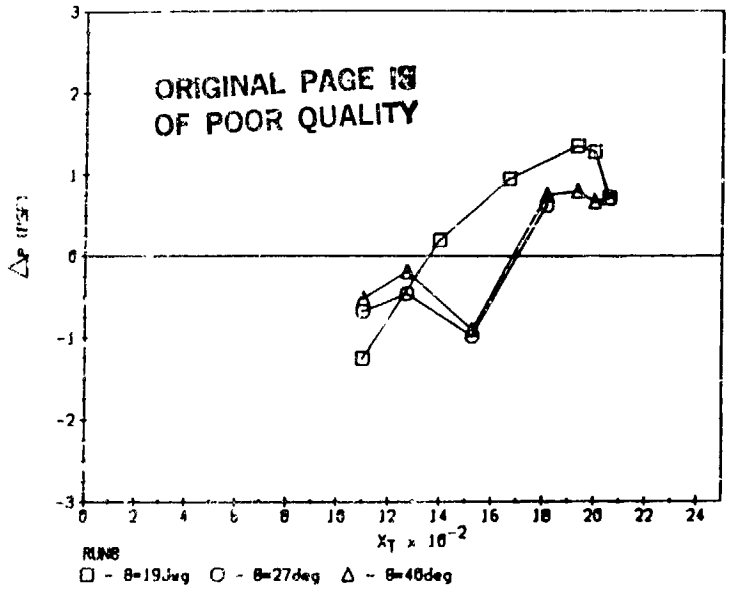


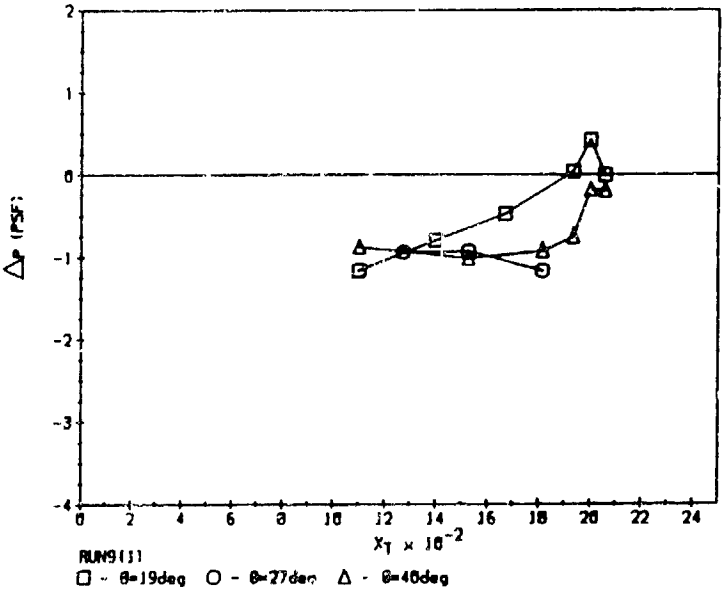


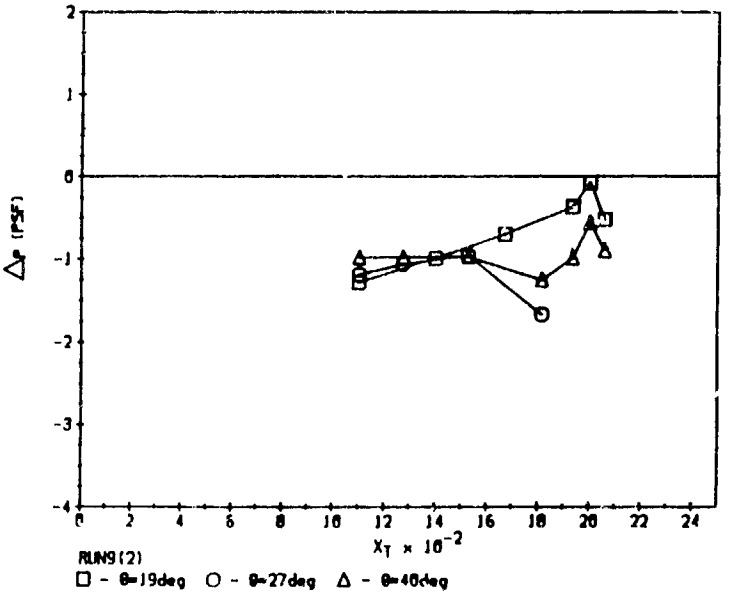


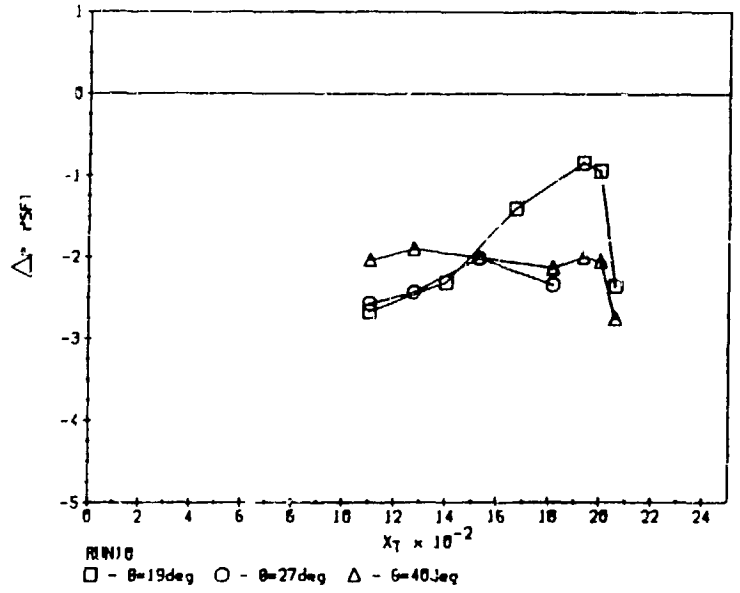


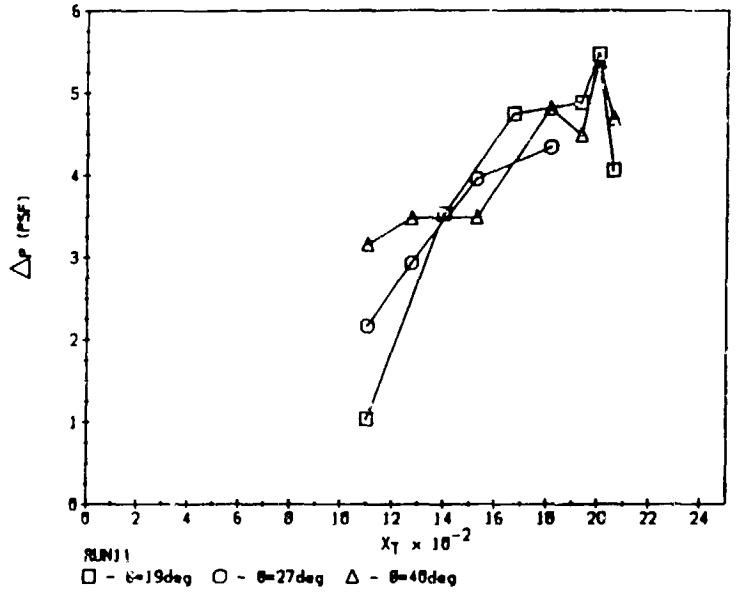


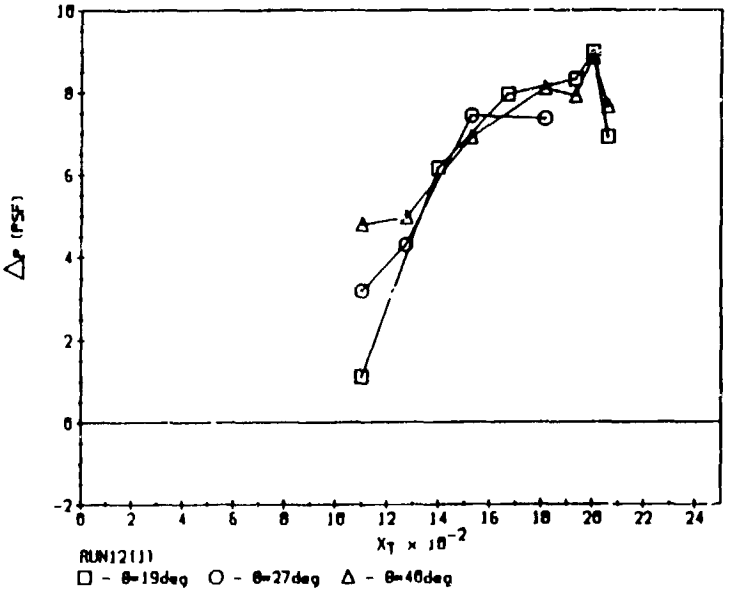


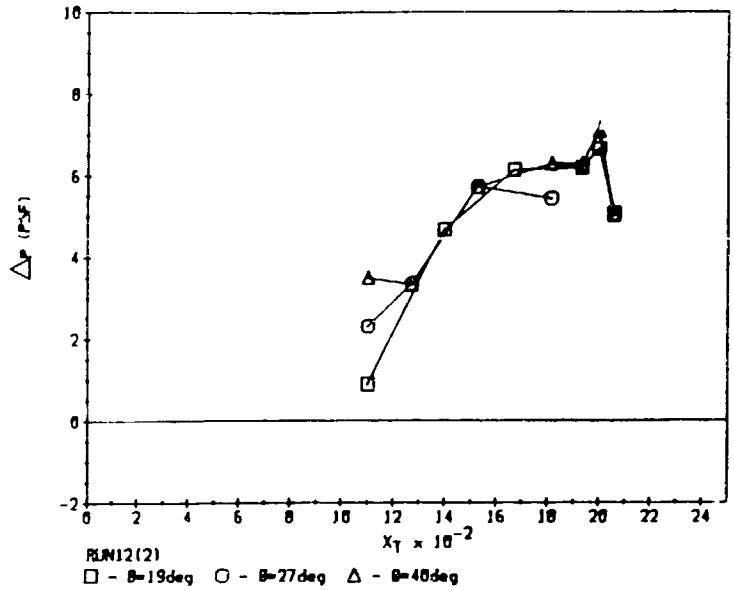


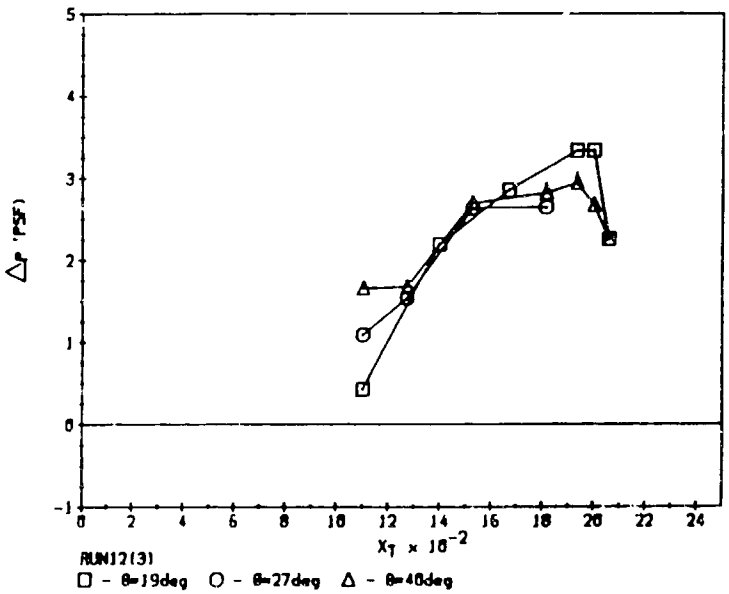


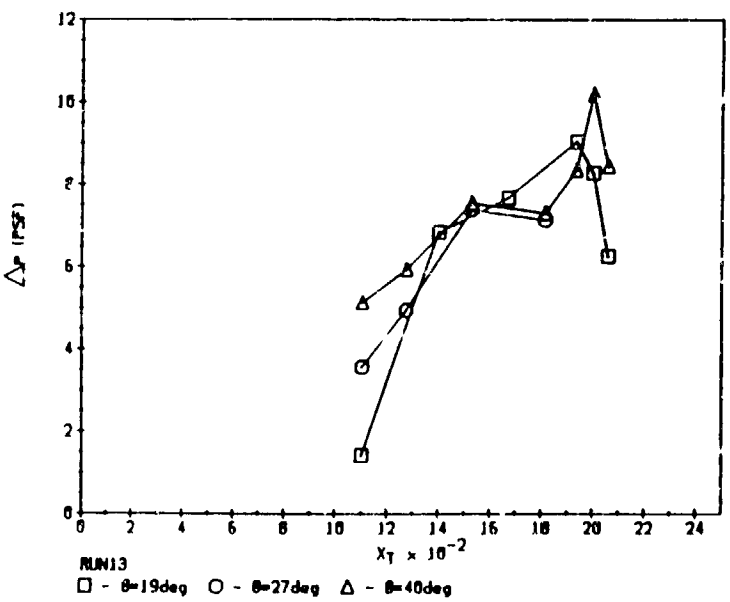


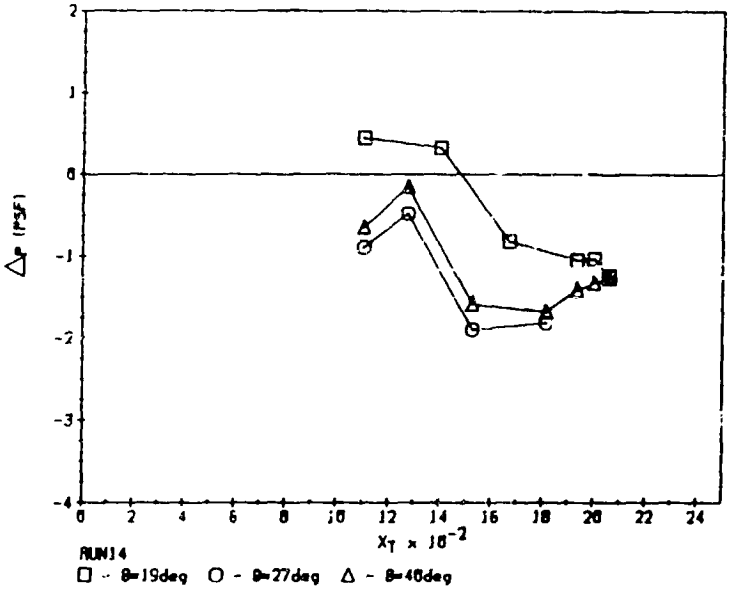


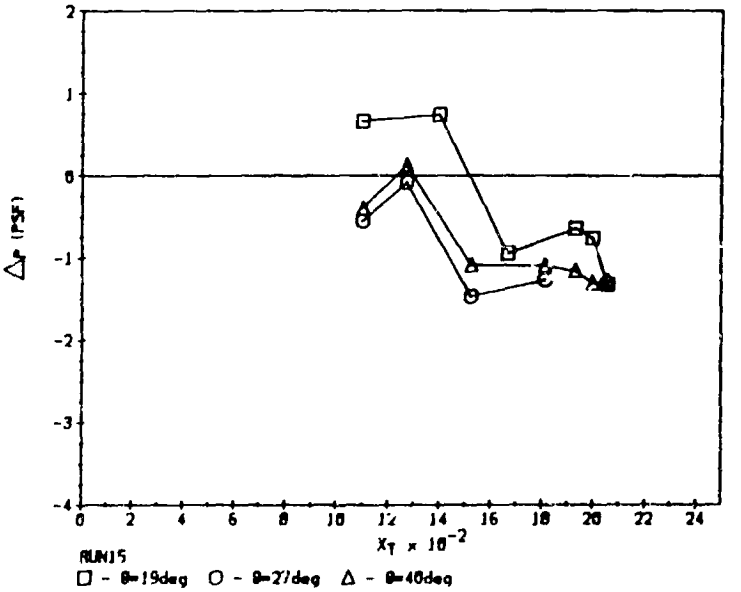


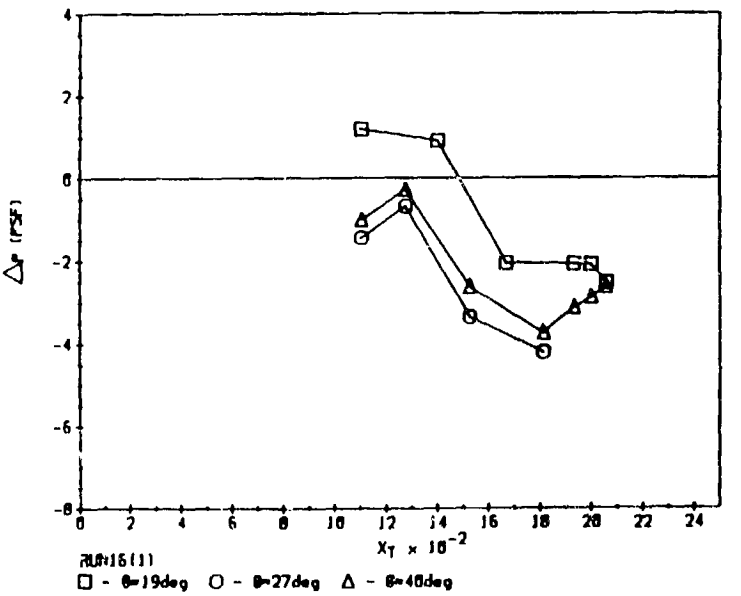


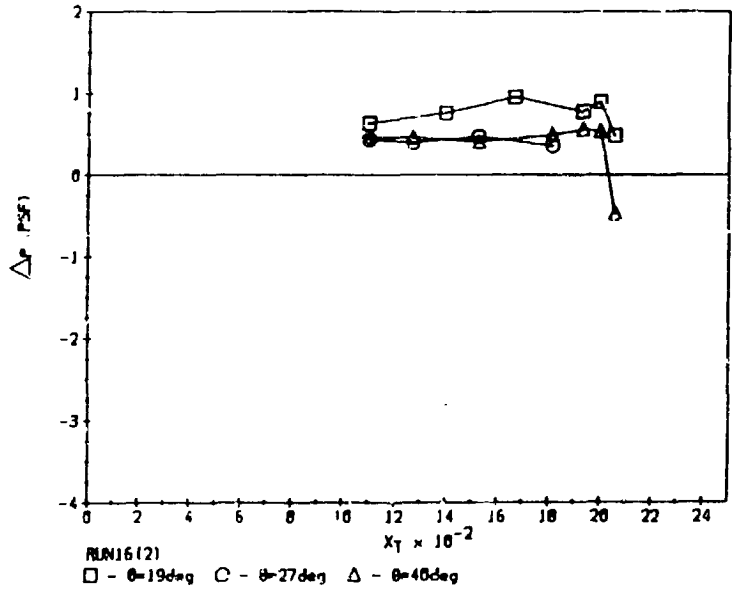




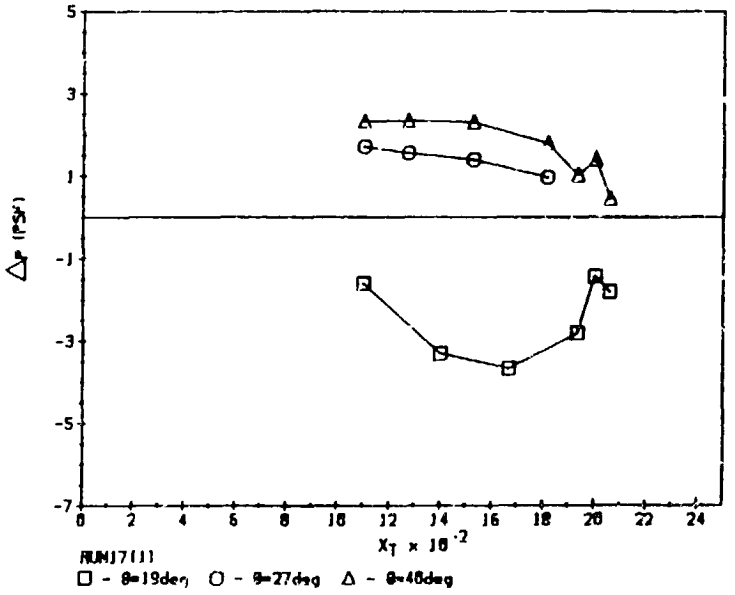




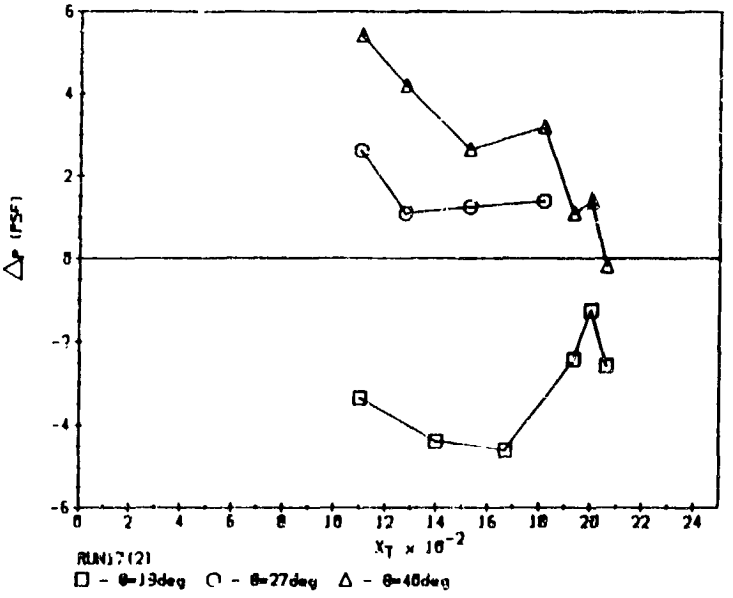




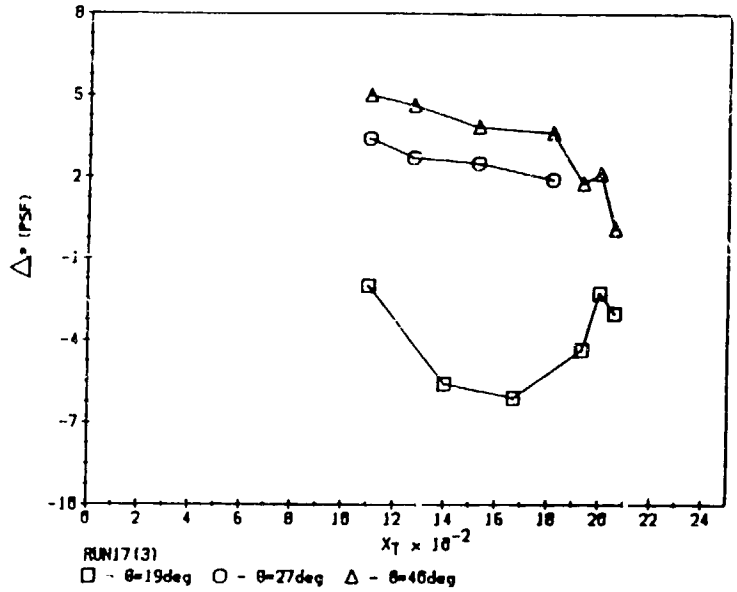
RUN16(2)
□ - θ=19deg ○ - θ=27deg △ - θ=46deg

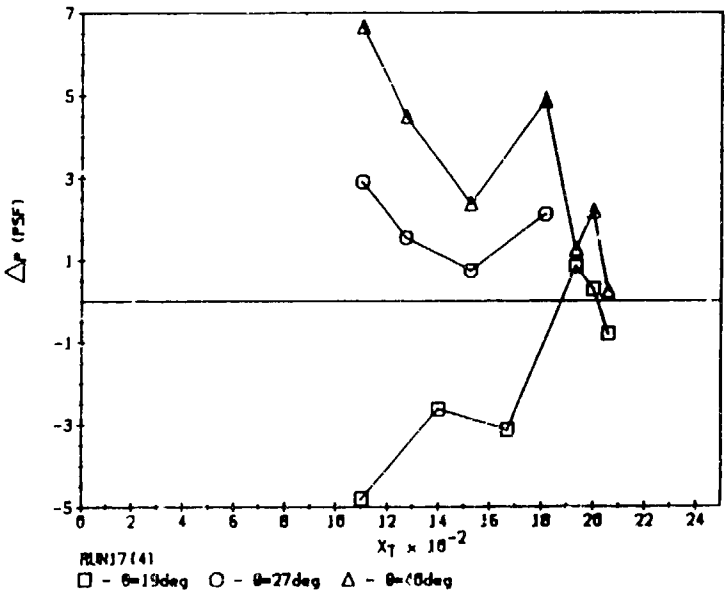


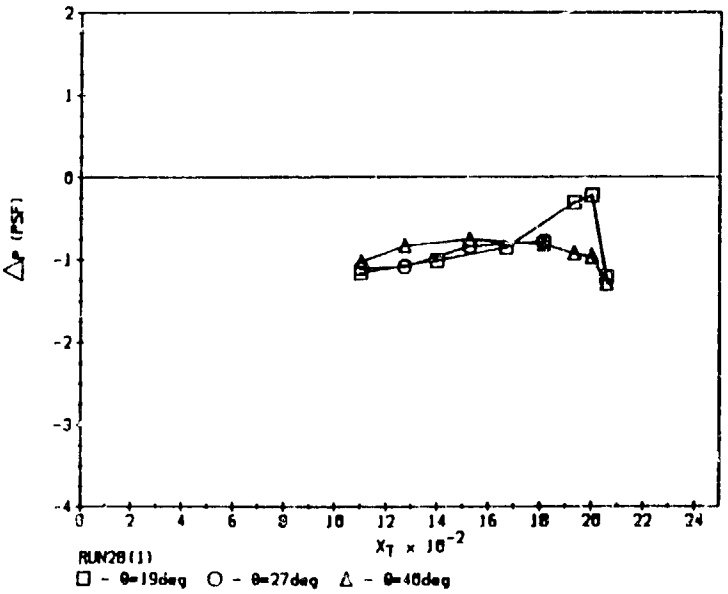
RUN17(1)
□ - θ=19deg ○ - θ=27deg △ - θ=46deg

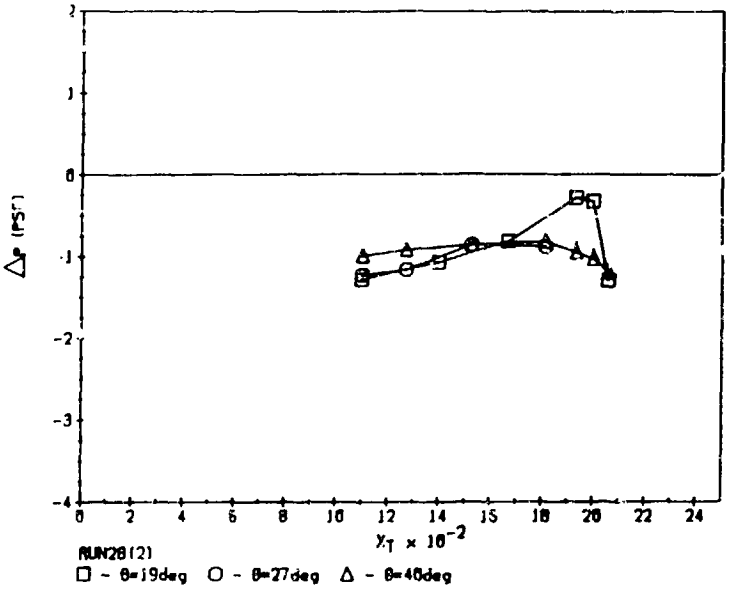


RUN17(2)
□ - θ=19deg ○ - θ=27deg △ - θ=46deg

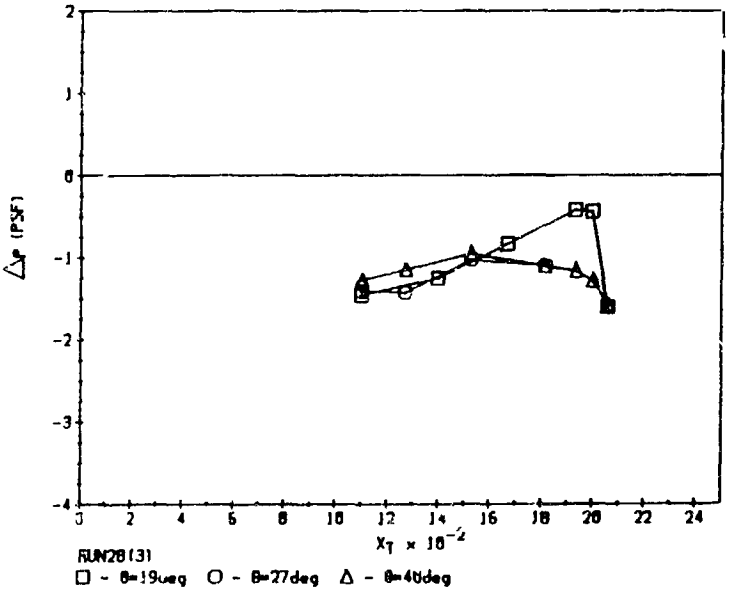




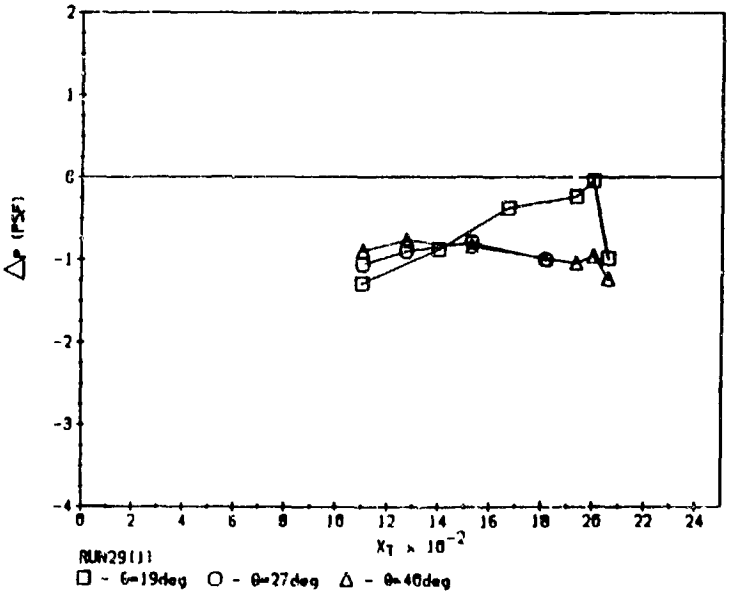




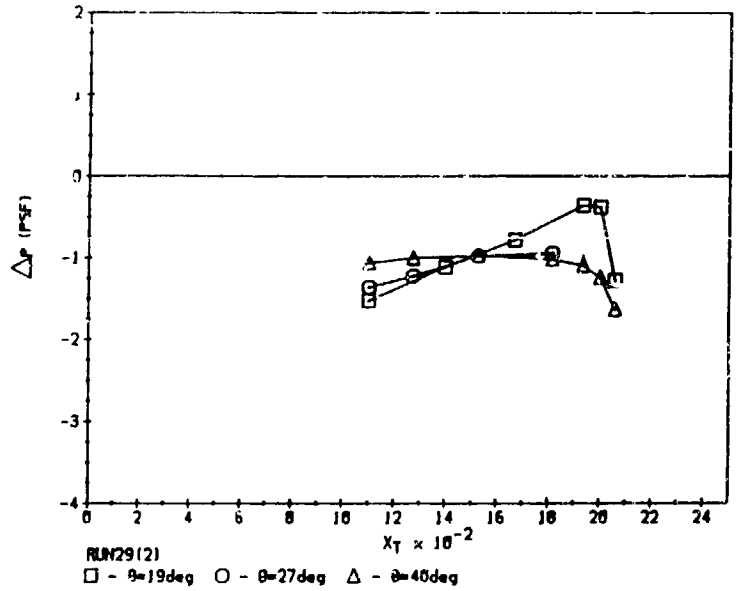
RUN28(2)
□ - θ=19deg ○ - θ=27deg △ - θ=40deg

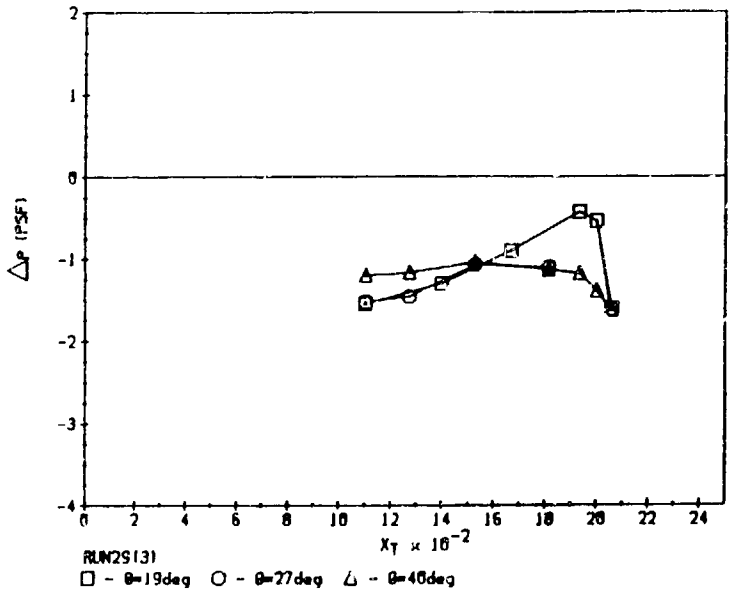


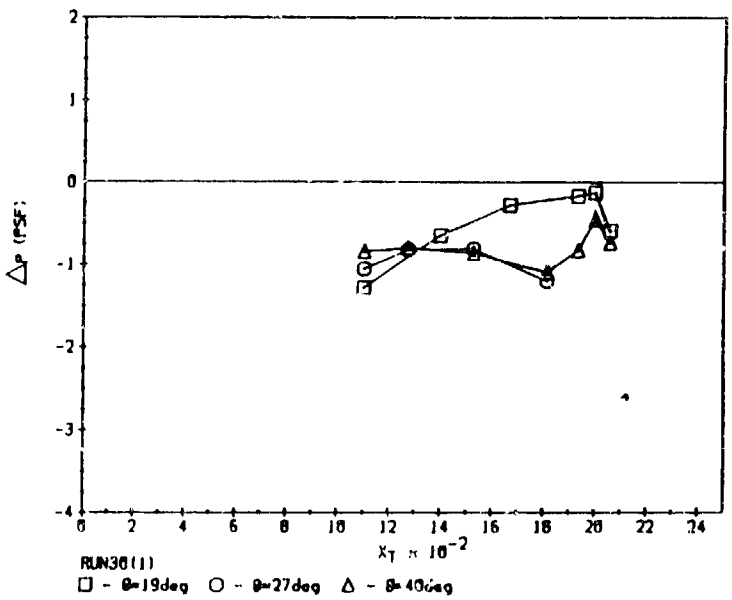
RUN28(3)
□ - θ=19deg ○ - θ=27deg △ - θ=40deg

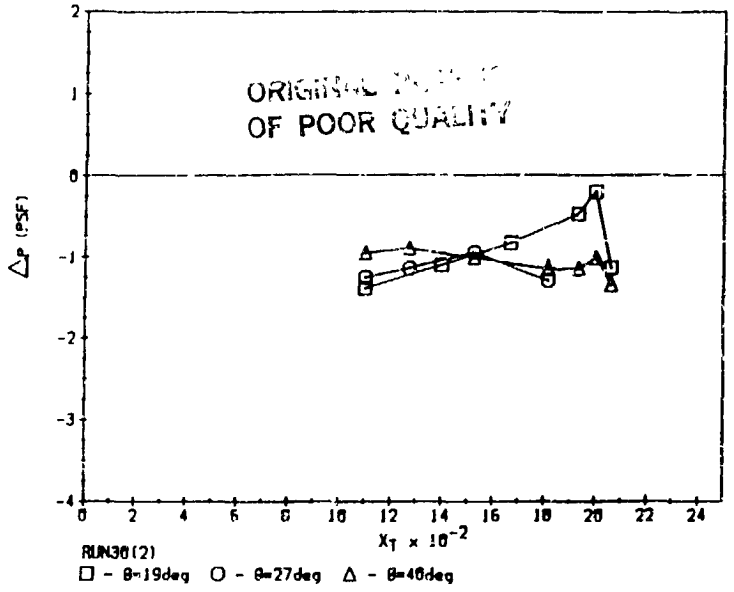


RUN29(1)
□ - θ=19deg ○ - θ=27deg △ - θ=40deg

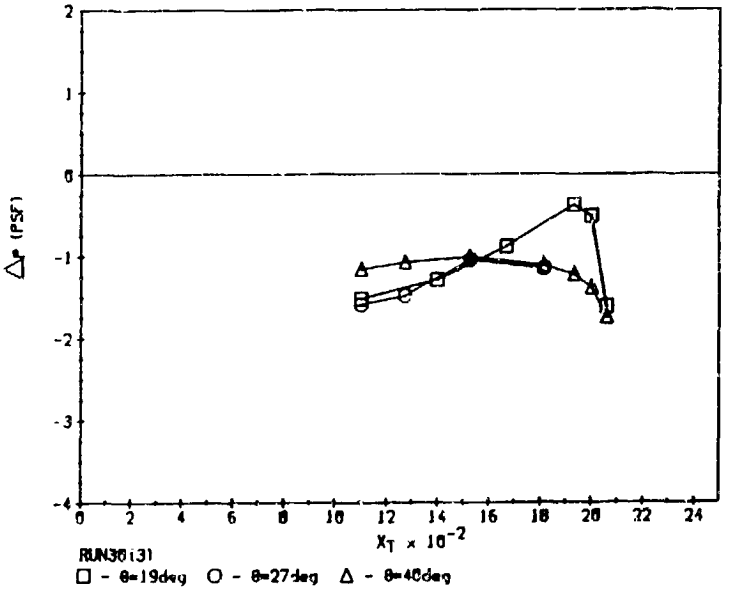




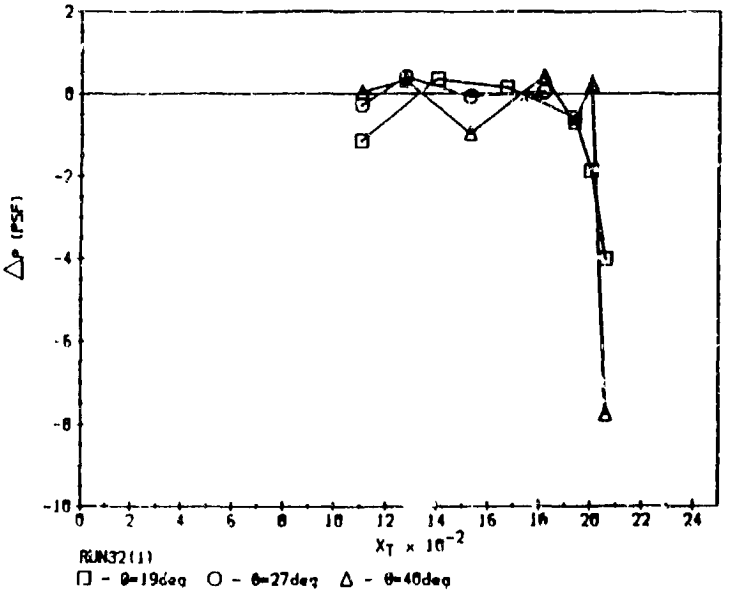




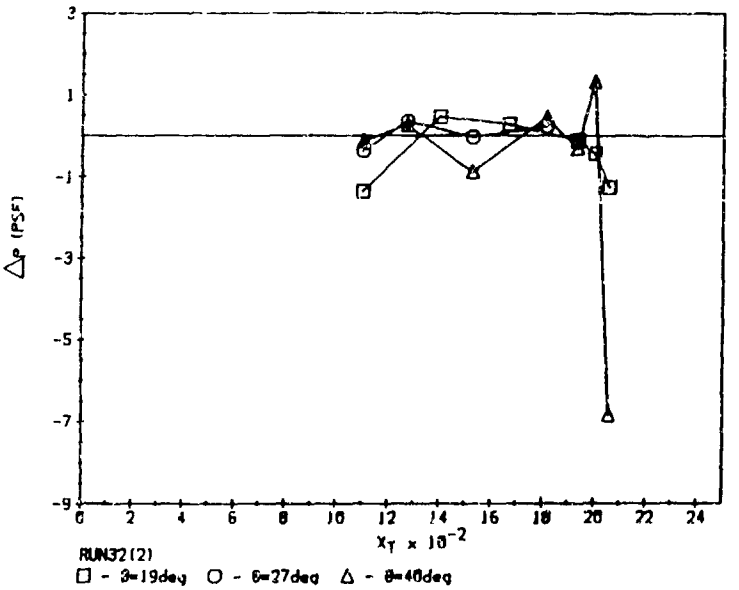
RUN30(2)
□ - θ=19deg ○ - θ=27deg △ - θ=40deg

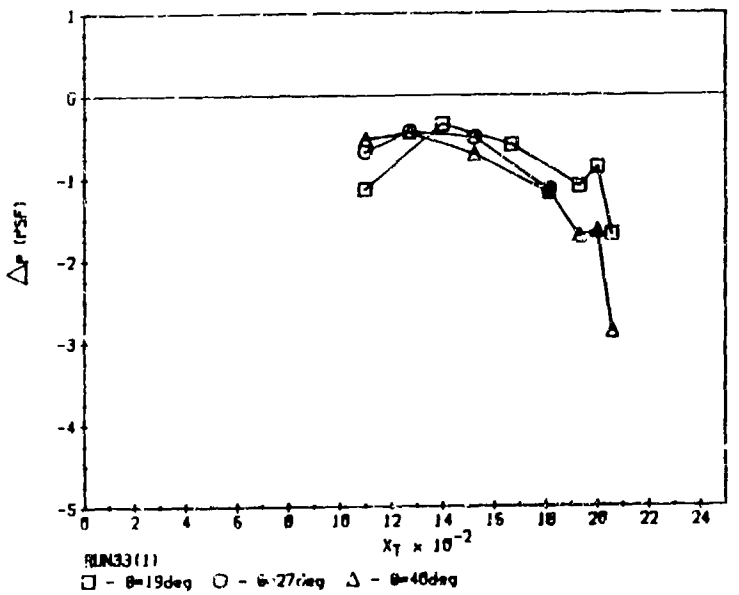


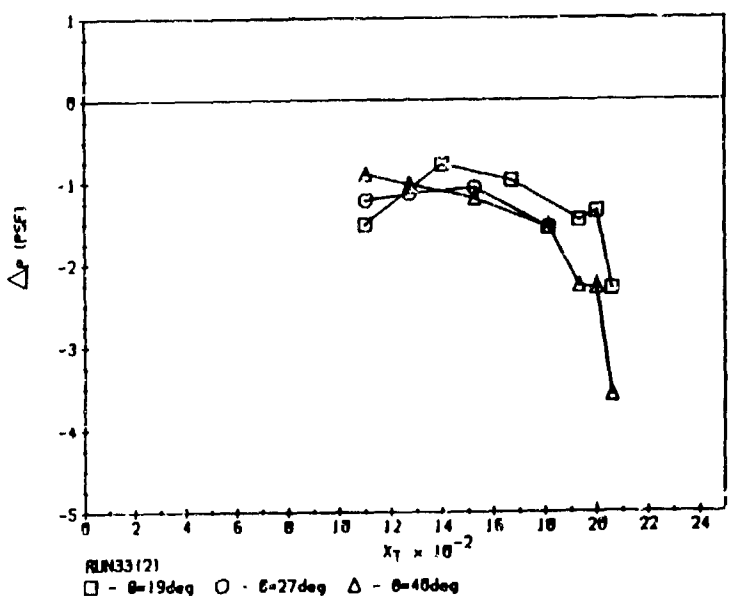
RUN30(3)
□ - θ=19deg ○ - θ=27deg △ - θ=40deg

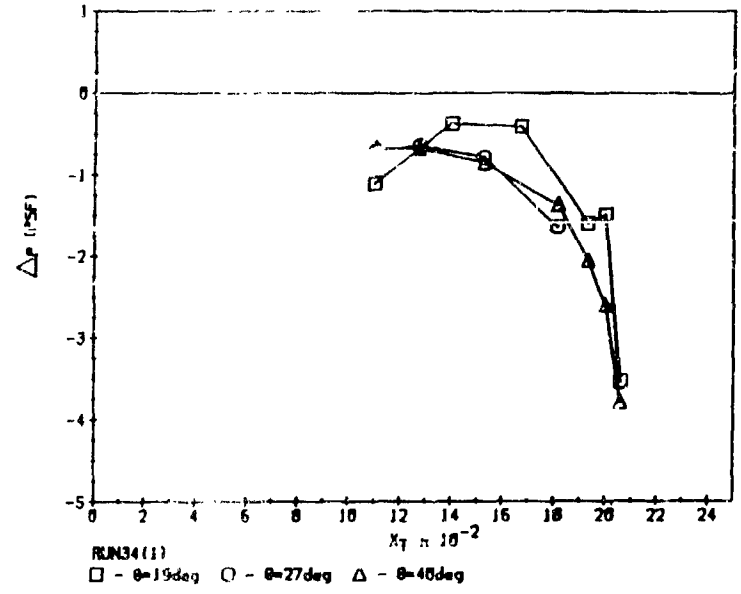


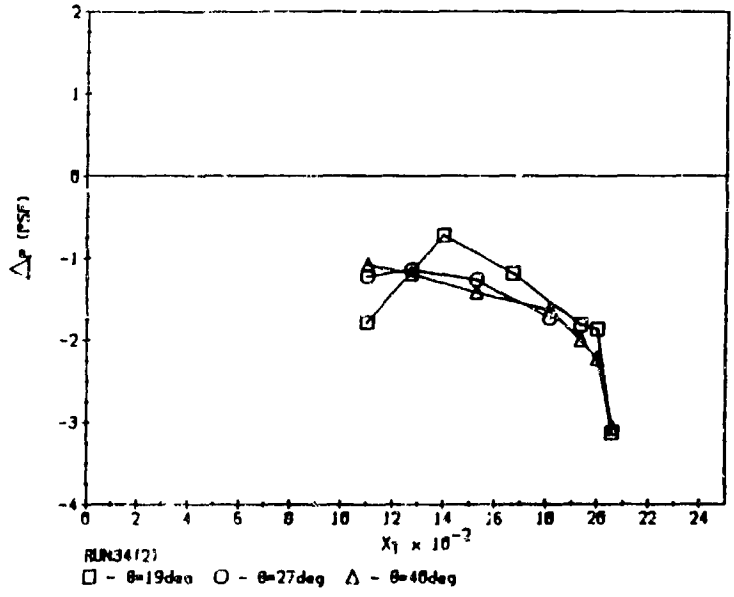
RUN32(1)
□ - θ=19deg ○ - θ=27deg △ - θ=40deg

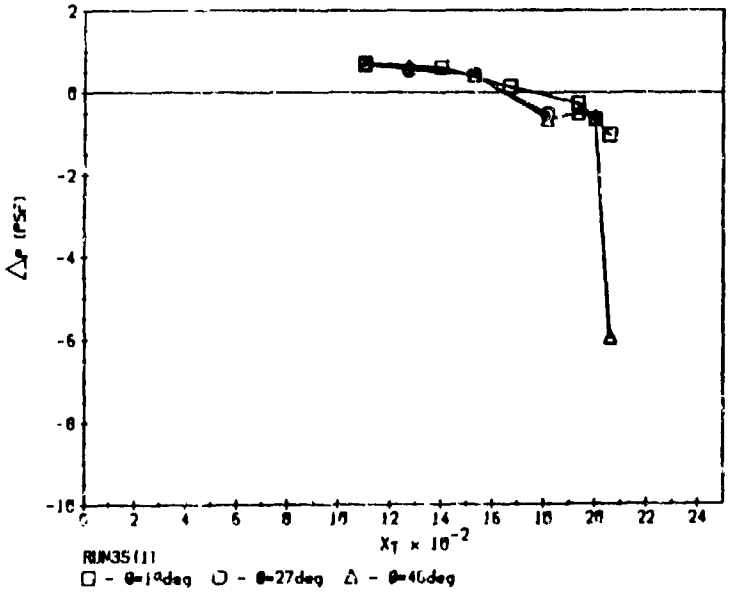


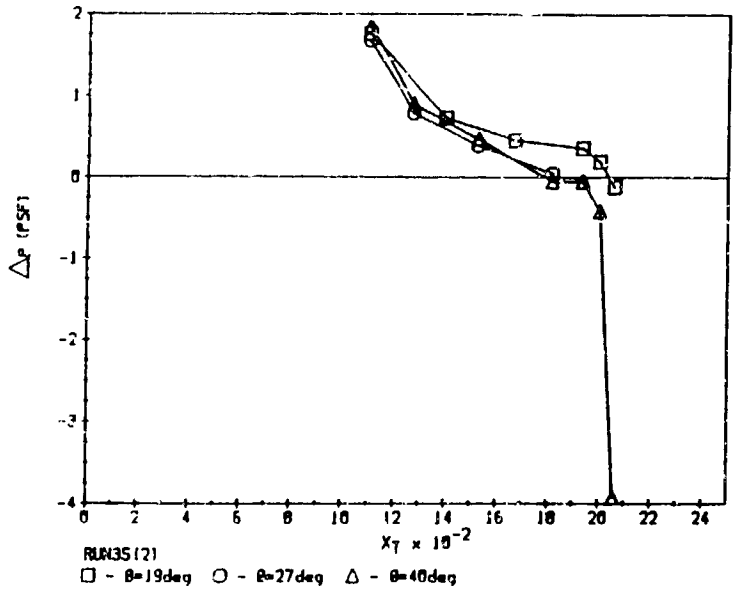


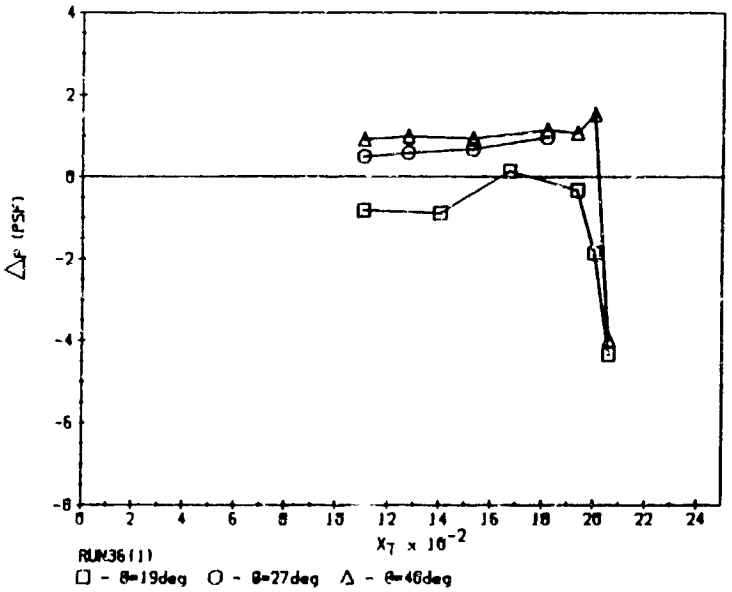


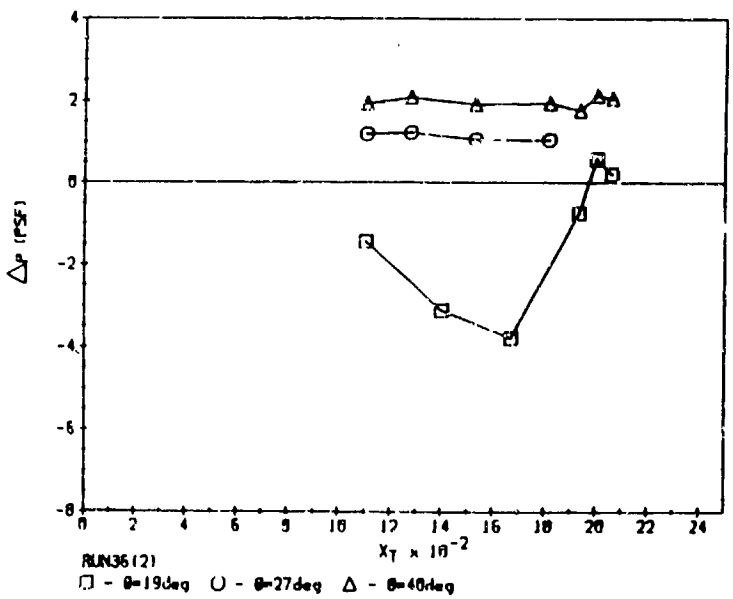


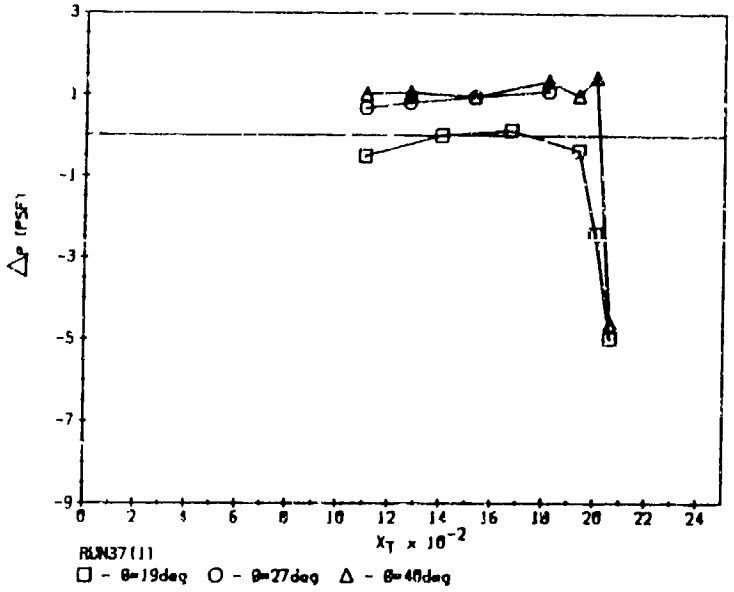


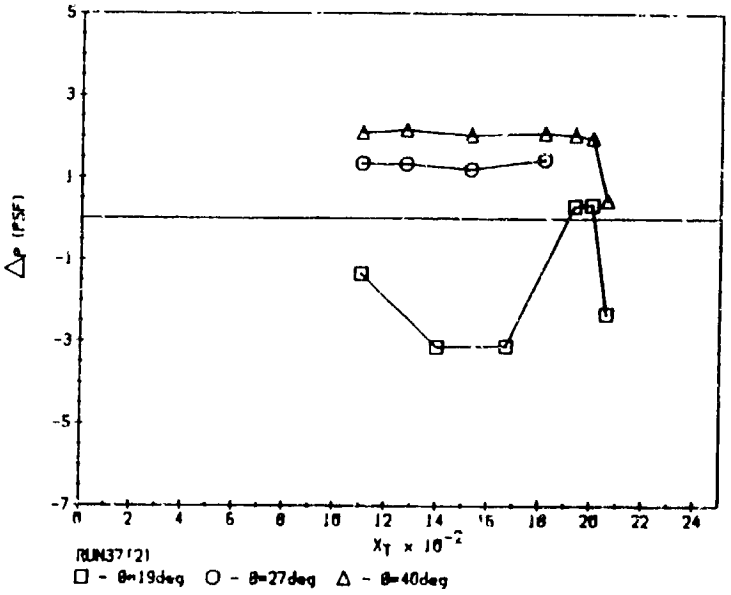


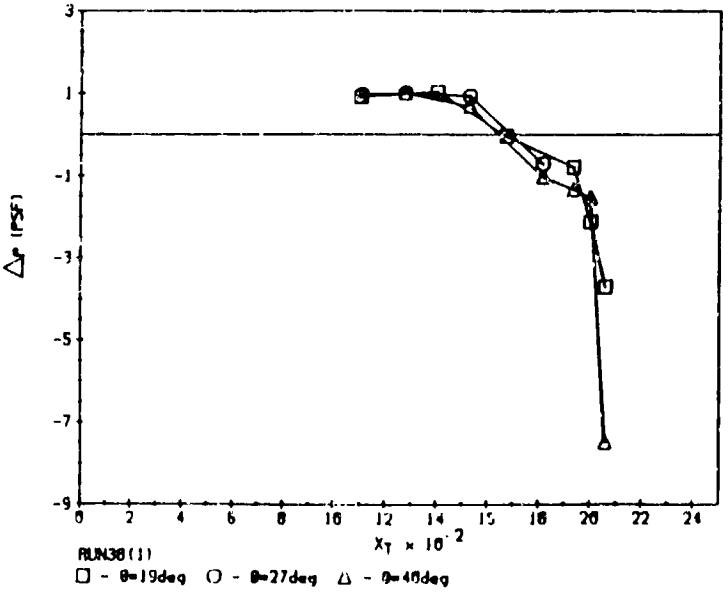


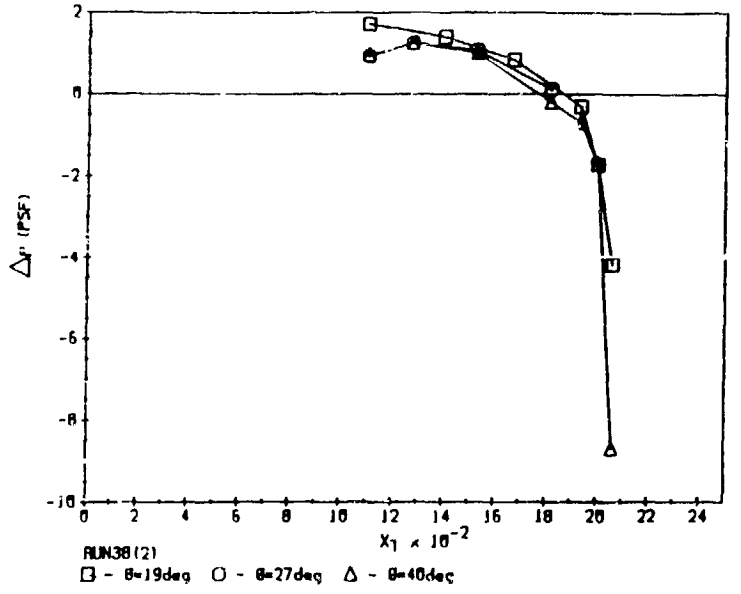


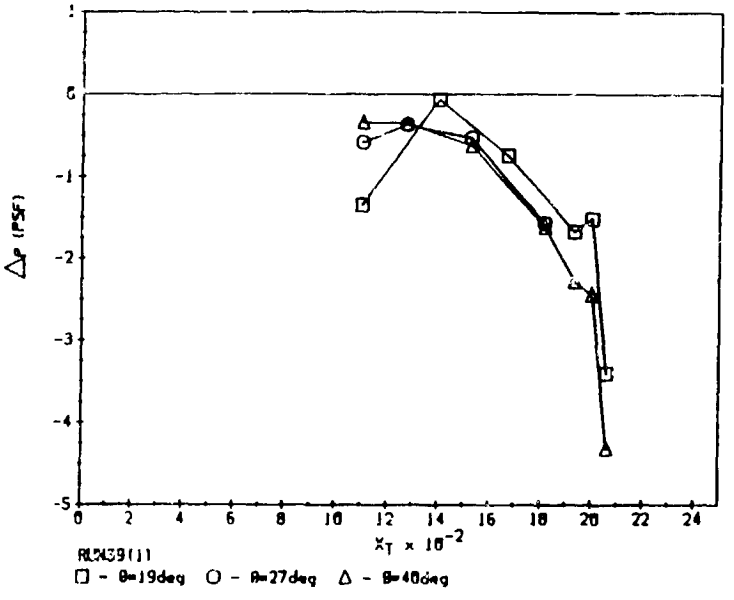


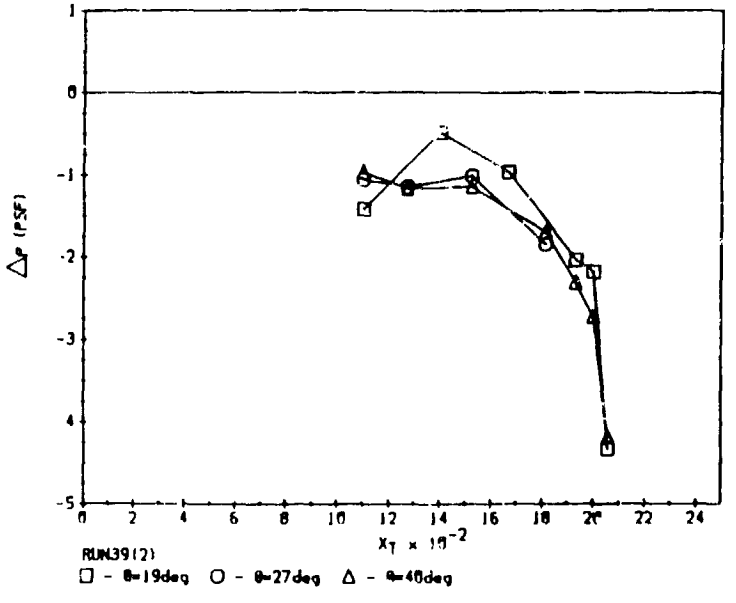


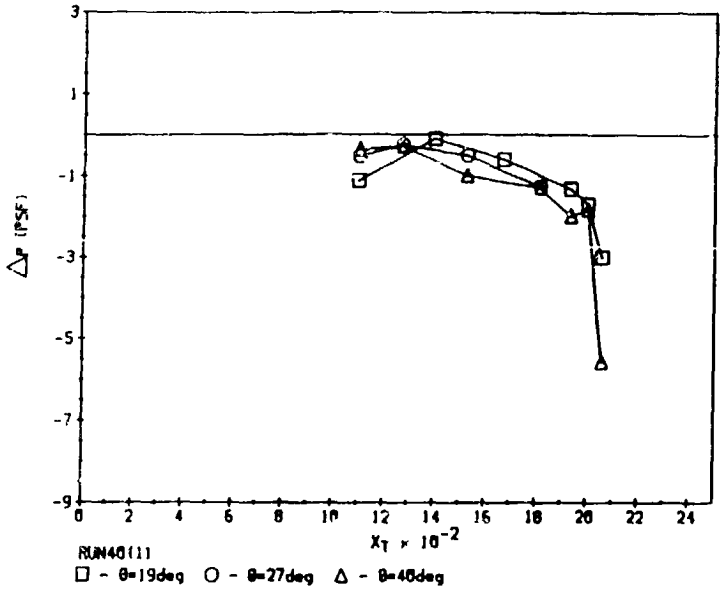


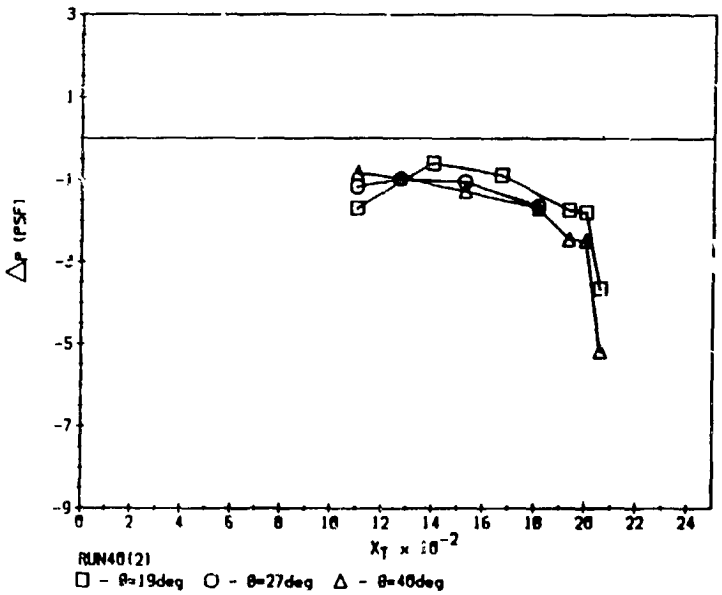


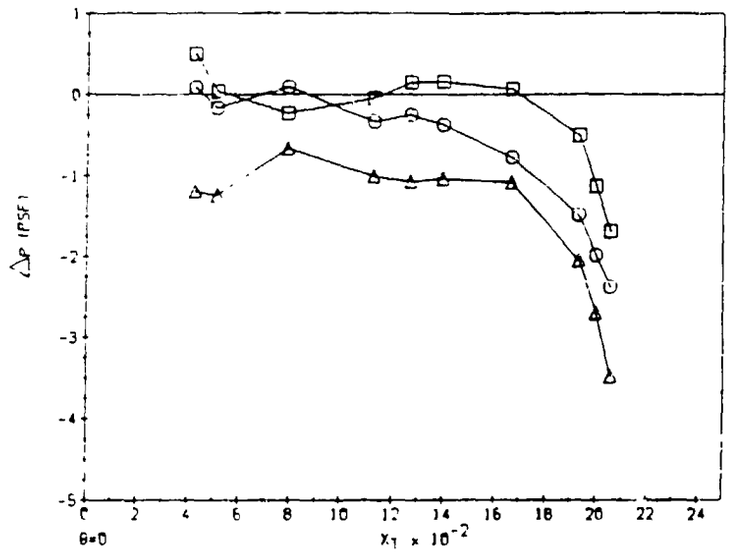


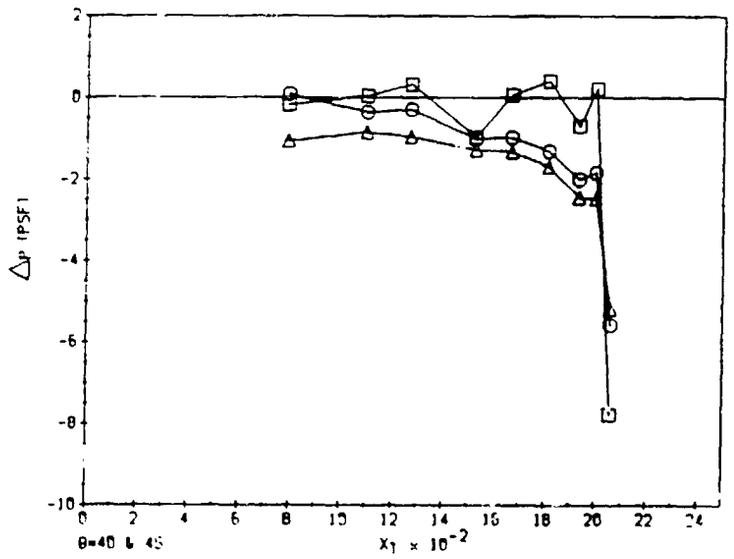


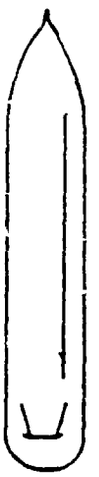


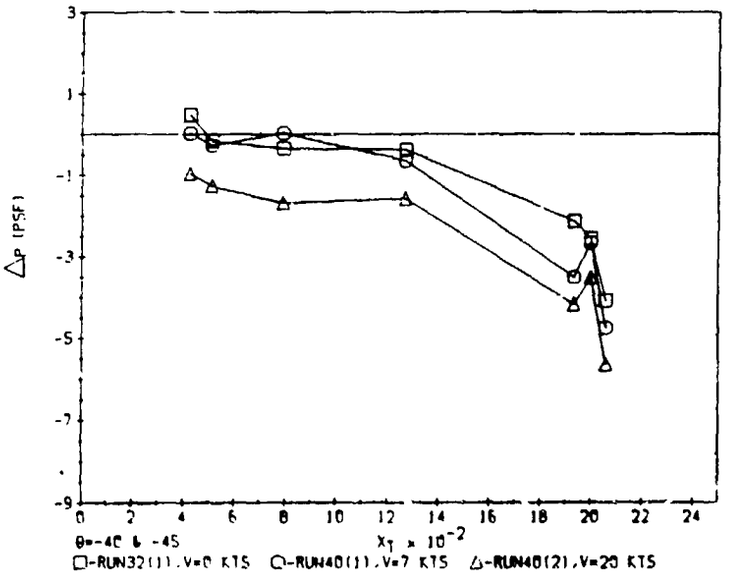












HOT-FILM DATA

NOMINAL CONFIGURATION

WIND CNLY, JETS ONLY, WIND AND JET COMPARISONS

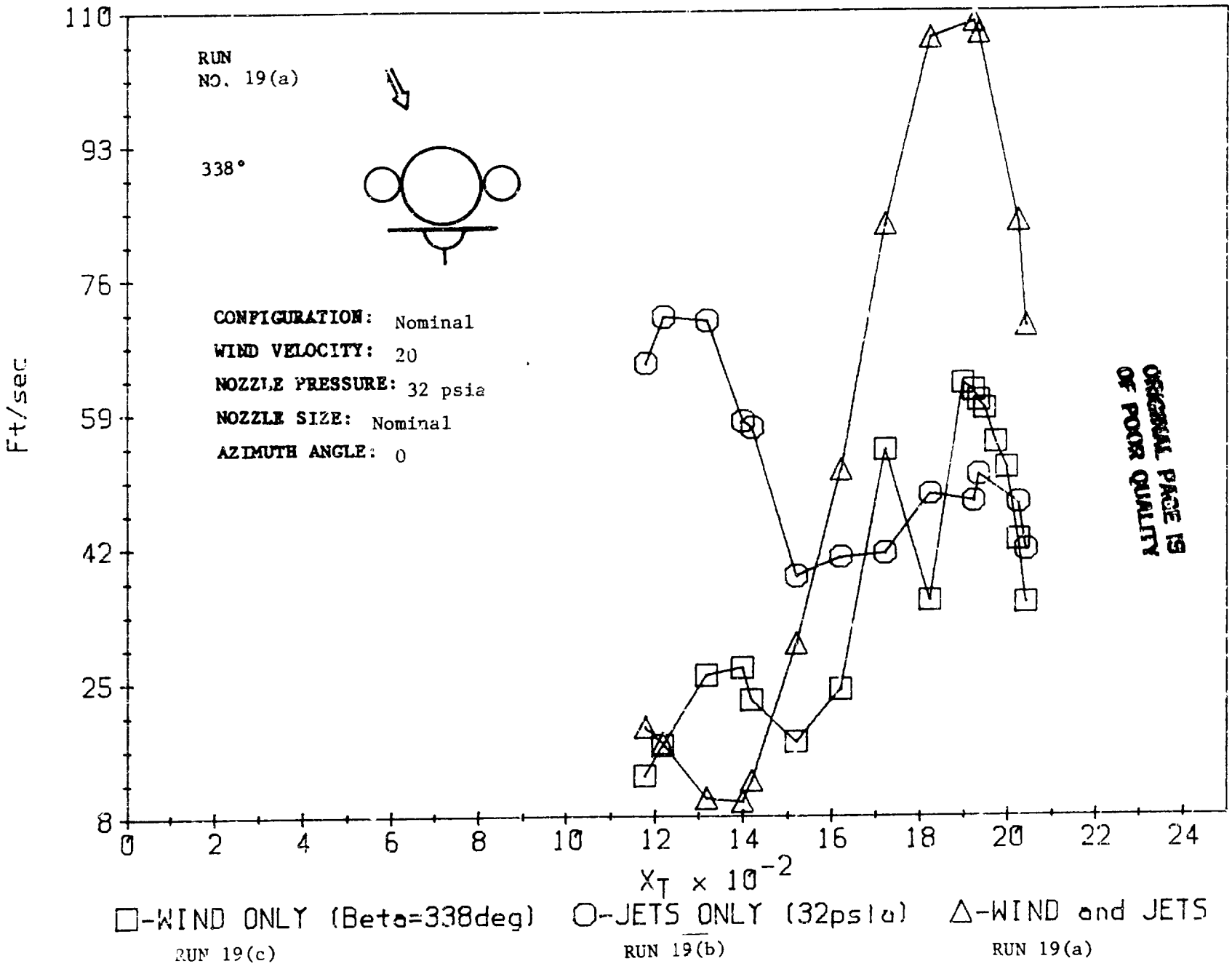
RUNS 19(c), 19(b), 19(a)

P = 32 psia N/A on 19(a)

V = 20 KNOTS N/A on 19(b)

$\phi = 0°$

$\beta = 338°$ N/A on 19(b)


RUN
NO. 19(a)
338°
CONFIGURATION: Nominal
WIND VELOCITY: 20
NOZZLE PRESSURE: 32 psia
NOZZLE SIZE: Nominal
AZIMUTH ANGLE: 0
Ft/sec
110
93
76
59
42
25
8
0
2
4
6
8
10
12
14
16
18
20
22
24
$X_T \times 10^{-2}$
□-WIND ONLY (Beta=338deg)
RUN 19(c)
○-JETS ONLY (32psia)
RUN 19(b)
△-WIND and JETS
RUN 19(a)
ORIGINAL PAGE IS OF POOR QUALITY

NOMINAL CONFIGURATION

WIND EFFECTS

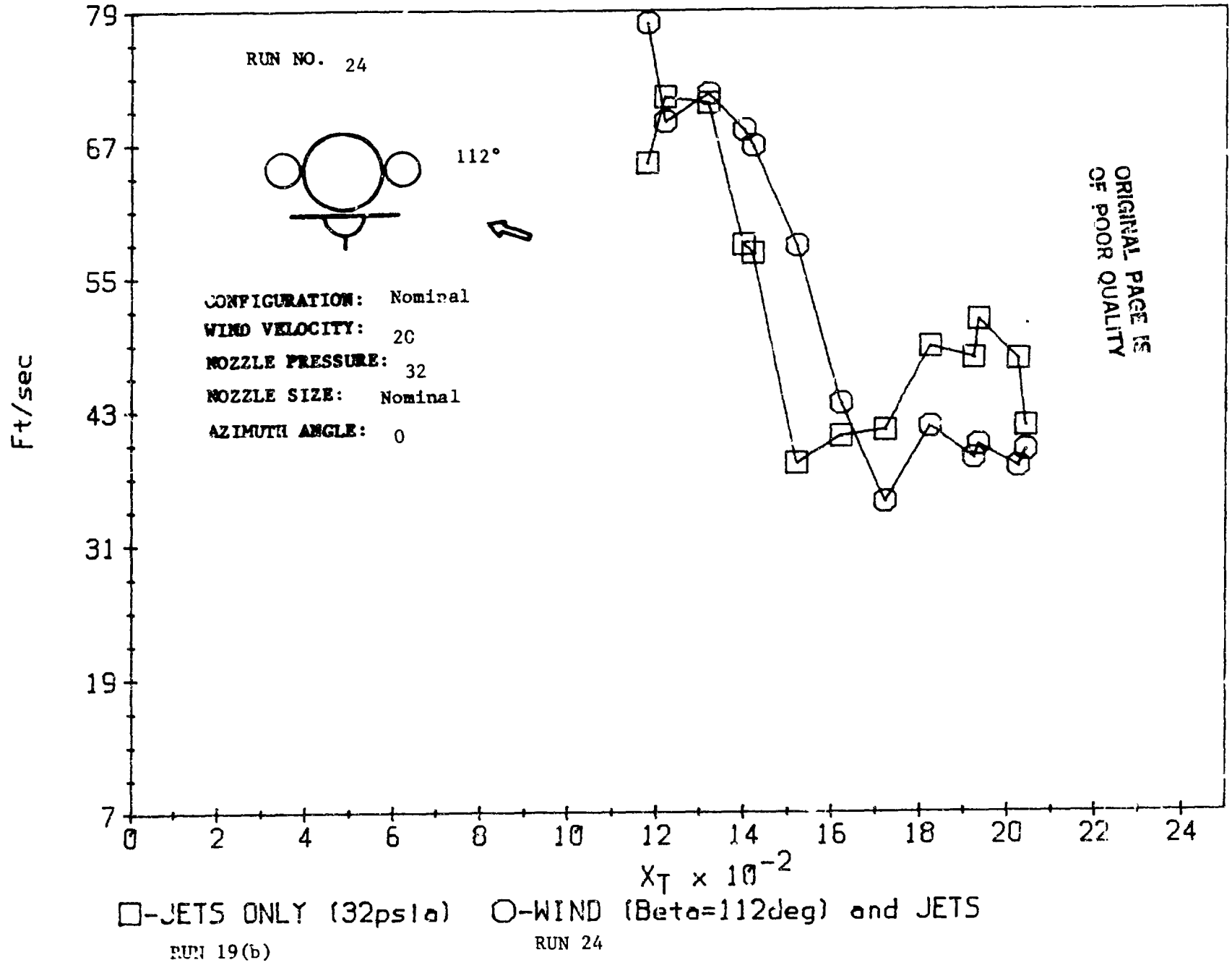
RUNS 19(b), 24

P = 32 psia

V = 20 KNOTS N/A on 19(b)

ϕ = 0°

β = 112° N/A on 19(b)


RUN NO. 24
112°
CONFIGURATION: Nominal
WIND VELOCITY: 20
NOZZLE PRESSURE: 32
NOZZLE SIZE: Nominal
AZIMUTH ANGLE: 0
ORIGINAL PAGE IS OF POOR QUALITY
Ft/sec
79
67
55
43
31
19
7
0
2
4
6
8
10
12
14
16
18
20
22
24
$X_T \times 10^{-2}$
□-JETS ONLY (32psia) ○-WIND (Beta=112deg) and JETS
RUN 19(b)
RUN 24

NOMINAL CONFIGURATION

VELOCITY SURVEYS

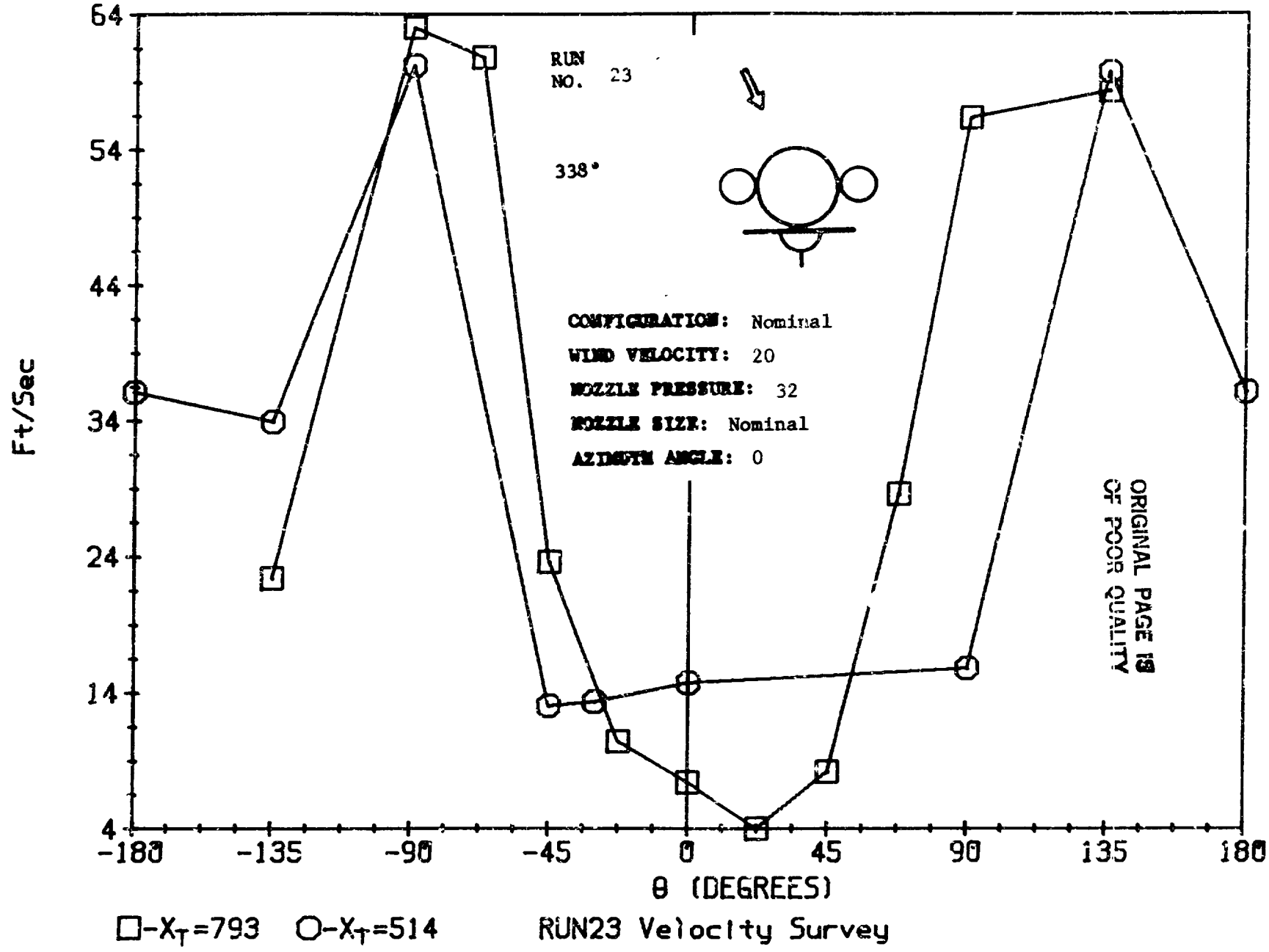
RUN 23

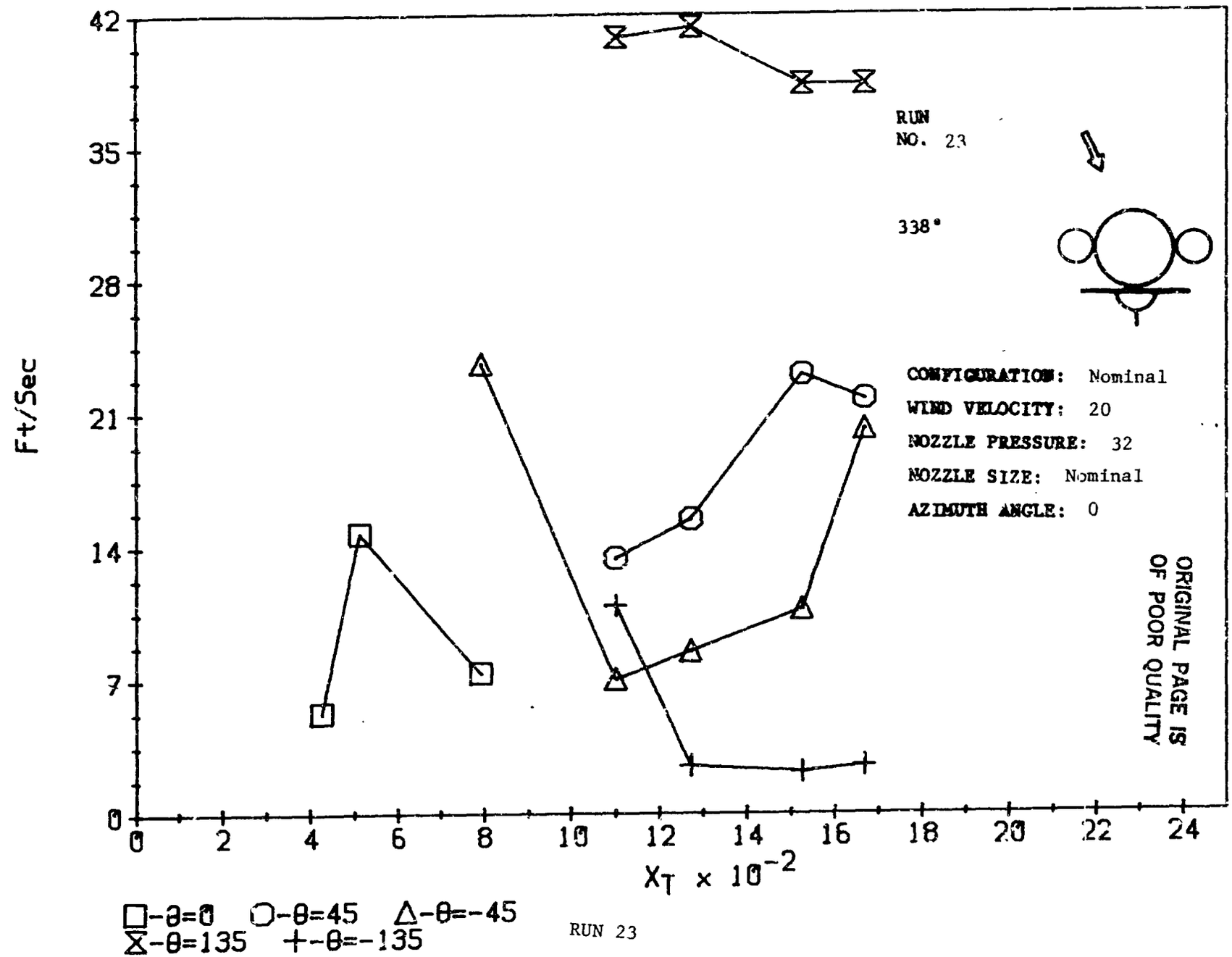
P = 32 psia

V = 20 KNOTS

ϕ = 0°

β = 338°




42
35
28
21
14
7
0
Ft/Sec
0
2
4
6
8
10
12
14
16
18
20
22
24
$X_T \times 10^{-2}$
RUN
NO. 23
338°
CONFIGURATION: Nominal
WIND VELOCITY: 20
NOZZLE PRESSURE: 32
NOZZLE SIZE: Nominal
AZIMUTH ANGLE: 0
ORIGINAL PAGE IS
OF POOR QUALITY
□-θ=0 ○-θ=45 △-θ=-45
⧖-θ=135 +-θ=-135
RUN 23

MARSHALL SPACE FLIGHT CENTER CONFIGURATION

VELOCITY AND TEMPERATURE SURVEYS

RUN 41.2

V = 20 KNOTS

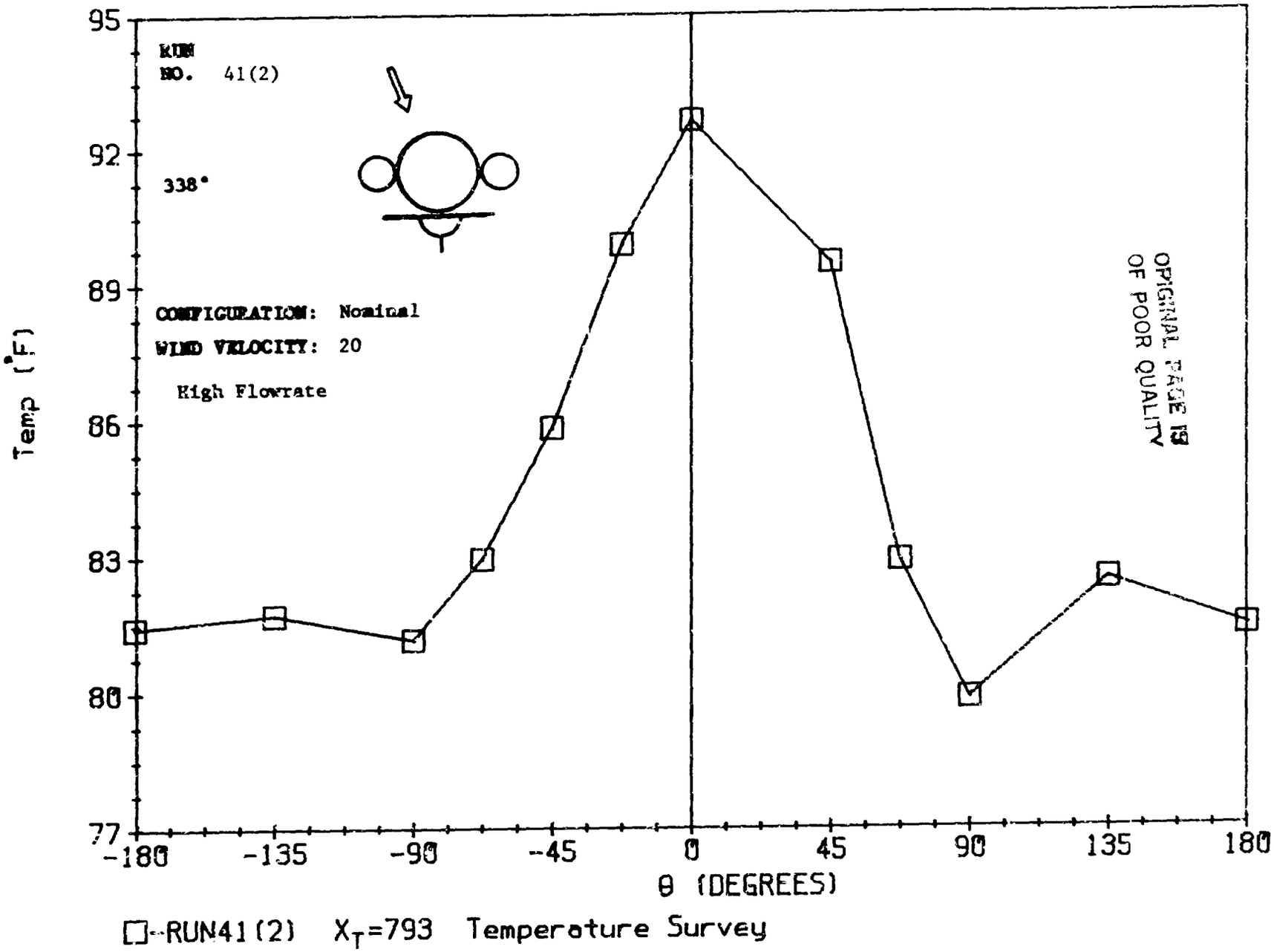
β = 338°

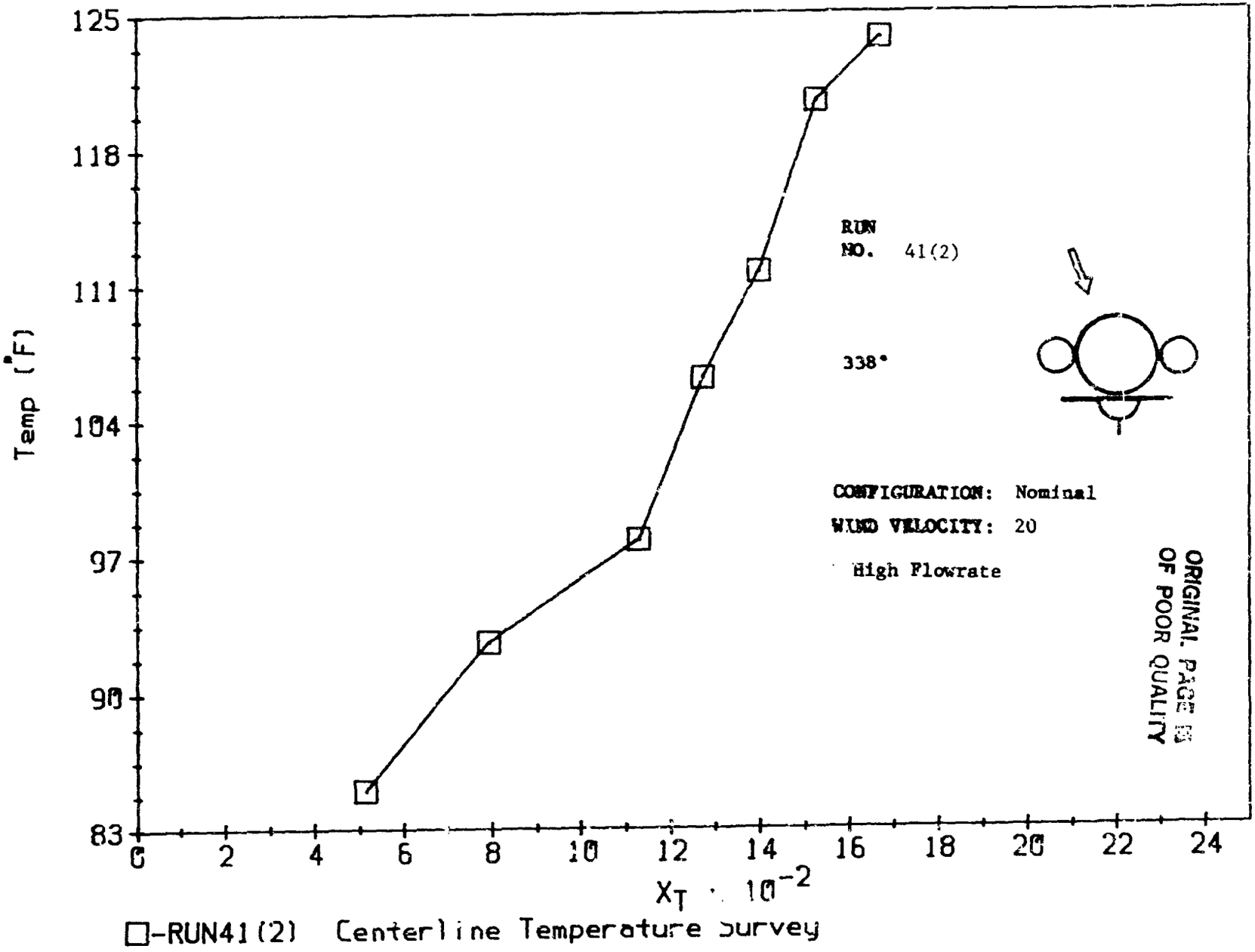
High Flowrate

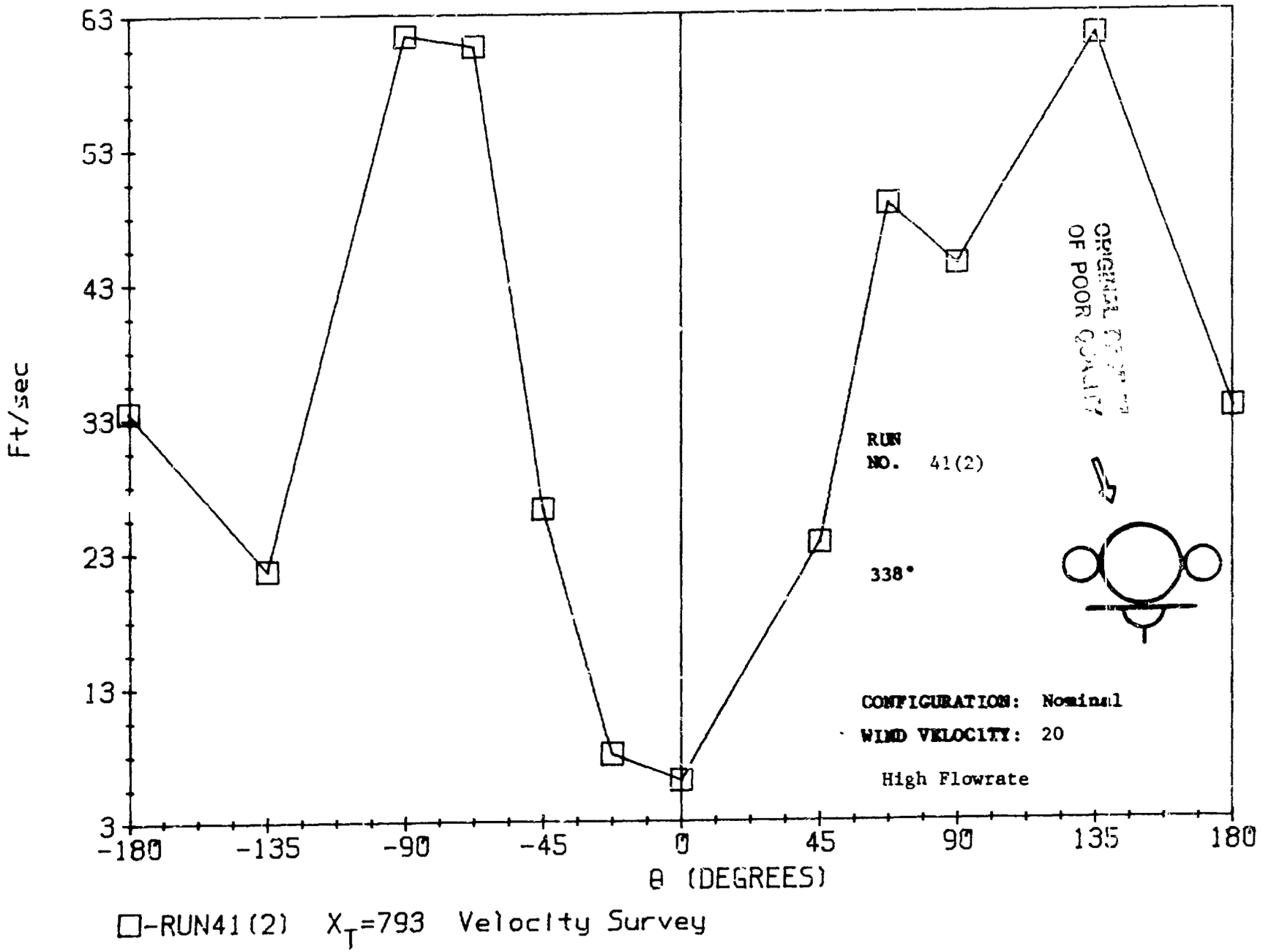
Nozzle Temp. = 197°F

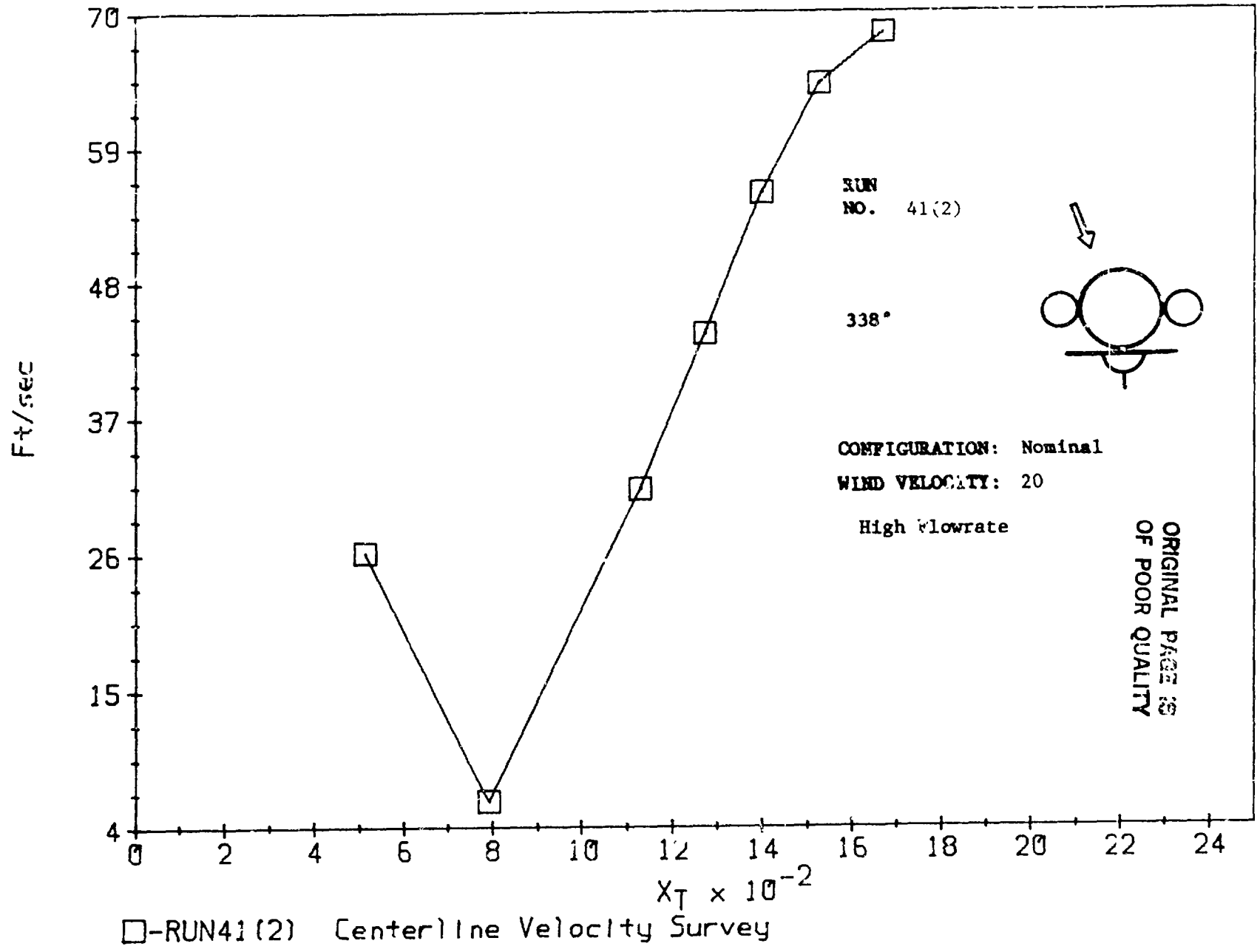
Test Section Temp.

prior to test start - 75°F




125
118
111
104
97
90
83
Temp (°F)
0
2
4
6
8
10
12
14
16
18
20
22
24
$X_T \cdot 10^{-2}$
RUN
NO. 41(2)
338°
CONFIGURATION: Nominal
WIND VELOCITY: 20
High Flowrate
ORIGINAL PAGE IS
OF POOR QUALITY
□-RUN41(2) Centerline Temperature Survey


63
53
43
33
23
13
3
Ft/sec
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
RUN
NO. 41(2)
338°
CONFIGURATION: Nominal
WIND VELOCITY: 20
High Flowrate
□-RUN41(2) X_T=793 Velocity Survey



MARSHALL SPACE FLIGHT CENTER CONFIGURATION

WIND VELOCITY EFFECTS

RUNS 42, 43

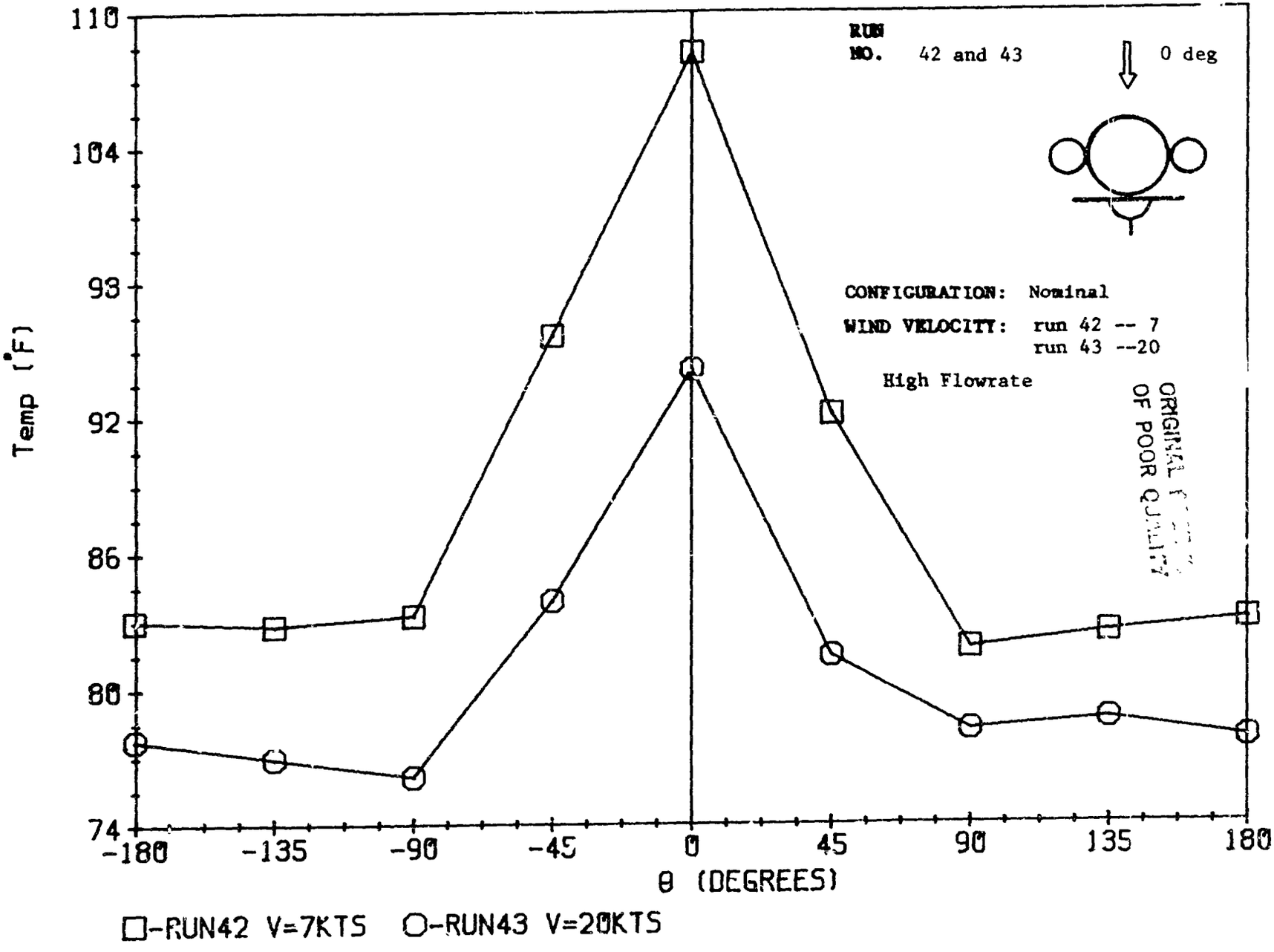
$\beta = 0°$

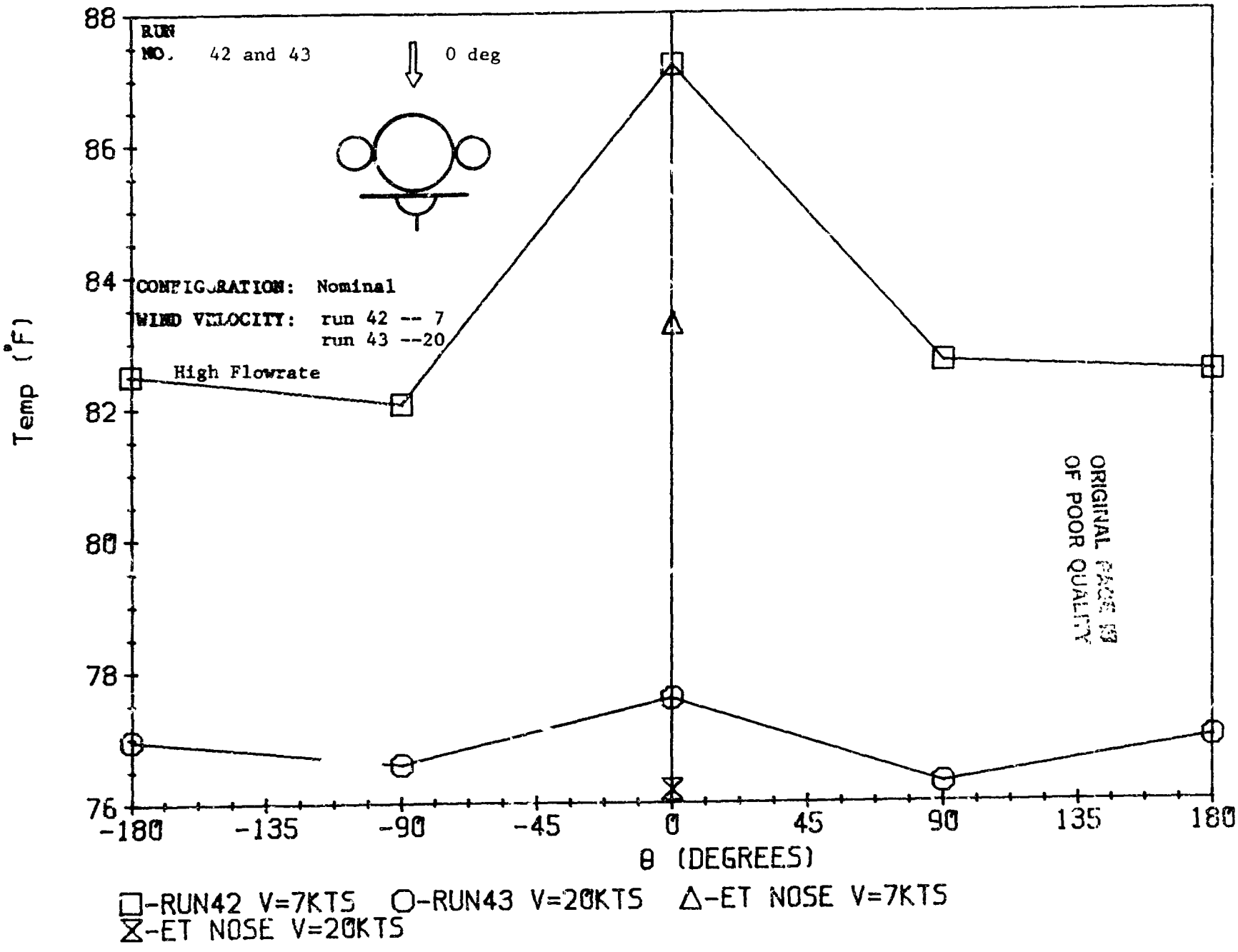
High Flowrate

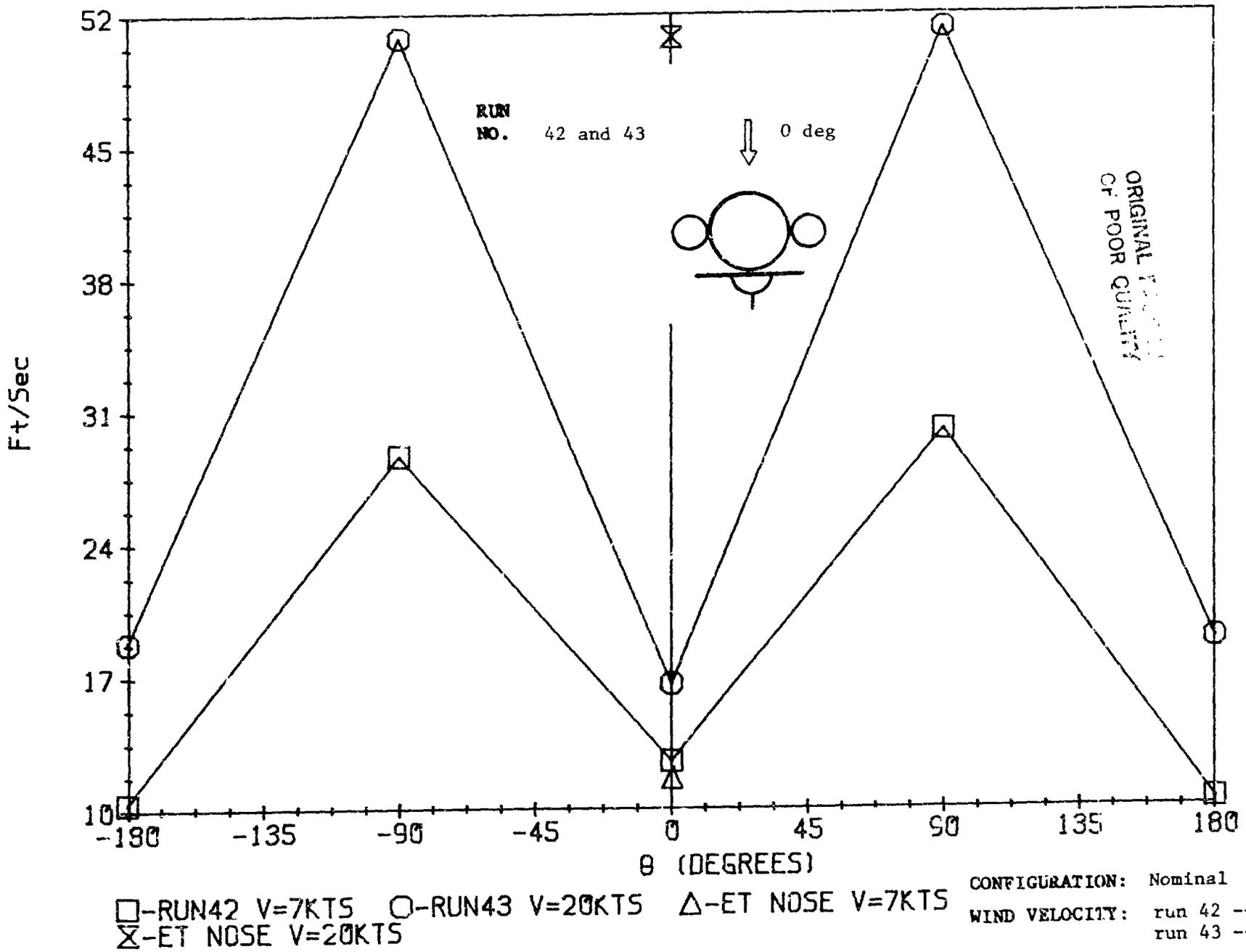
Nozzle Temp. = 197°F

Test Section Temp.

prior to test start = 75°F


RUN
NO. 42 and 43
0 deg
CONFIGURATION: Nominal
WIND VELOCITY: run 42 -- 7
run 43 --20
High Flowrate
ORIGINAL PAGE IS
OF POOR QUALITY
Temp (°F)
110
104
98
92
86
80
74
-180
-135
-90
-45
0
45
90
135
180
θ (DEGREES)
□-RUN42 V=7KTS ○-RUN43 V=20KTS

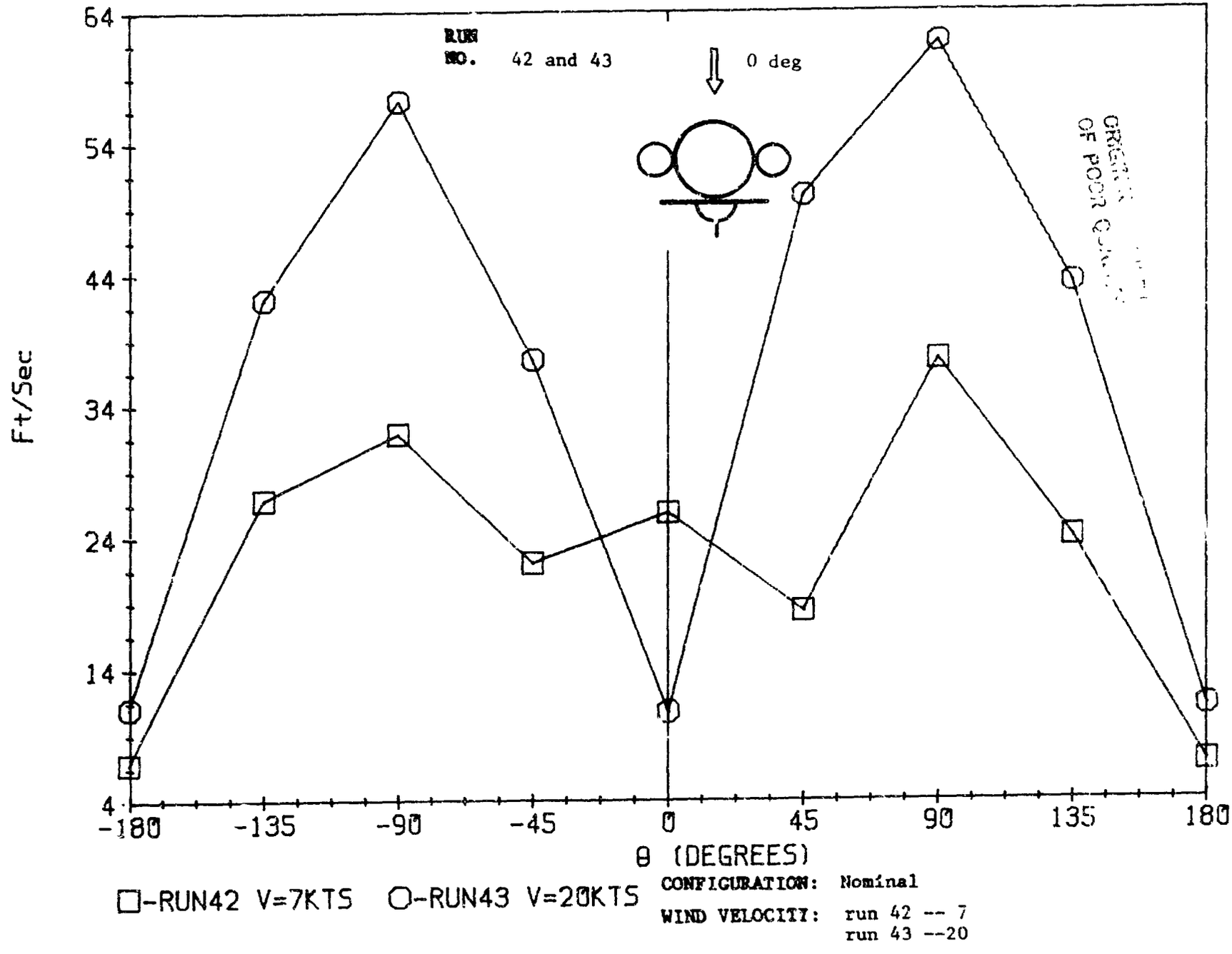




CONFIGURATION: Nominal

WIND VELOCITY: run 42 -- 7
run 43 --20

High Flowrate



High Flowrate